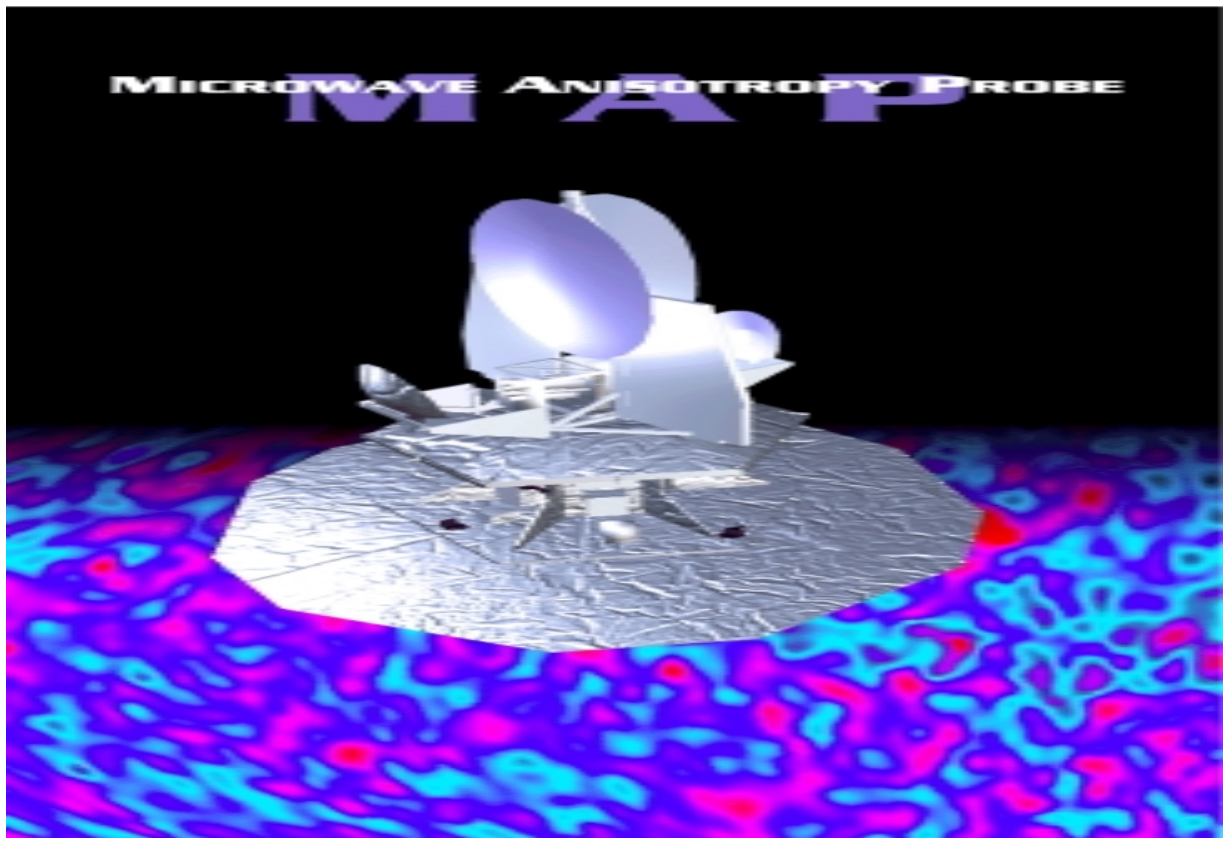
MAP Operations Readiness Review



May 11, 2001

AGENDA

8:30	**Opening Remarks**	**William Mack**
8:40	**Introduction**	**Steven Coyle**
9:00	**Science Operations Status**	**Gary Hinshaw**
9:20	**Ground Systems Status**	**Steven Coyle**
9:35	**DSN Readiness**	**Allen Berman**
9:50	**SN Readiness**	**Tom Bialas**
10:00	**BREAK**	

AGENDA, Con't

Agenda

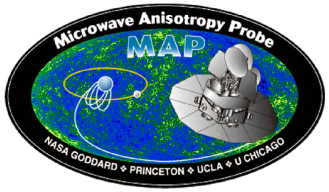
10:10	**Mission Timelines**	**Steven Coyle** **Bruce Twambly** **Stephen Andrews**
11:00	**Mission Operations Status**	
	Mission Readiness Testing	**Steven Coyle**
	Configuration Management	**Bruce Twambly**
	Procedures Development	**Bruce Twambly**
	Contingencies	**Peter Gonzales**
	Staffing and Facilities	**Steven Coyle**
	Launch Management	**Steven Coyle**
	Training	**Steven Coyle**
11:50	**Flight Dynamics Status**	
	Trajectory	**Osvaldo Cuevas**
	Orbit Determination	**Dale Fink**
	Attitude/Calibration	**Rick Harman**
12:25	**Flight Software Status**	**Jane Marquart**
12:40	**Conclusion**	**Steven Coyle**

Review Chairman's Comments

Bill Mack

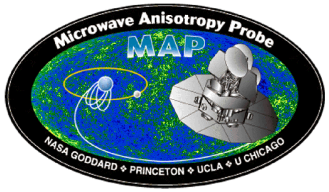
Introduction

Steven Coyle



Overview

- Lead Institution: GSFC in partnership with Princeton
- Instrument is a passively cooled differential radiometer with dual Gregorian reflectors to measure the CMB
- Launch on a Delta II 7425-10 from the ER
  - Launch is June 30, 2001
  - Star 48 third stage
- Lunar gravity assist trajectory out to L2
  - 3 (or 5) Phasing Loops before Lunar Encounter
  - 90 day cruise to L2 insertion
  - 2 year primary mission life at L2, with 3 year extended life option
- Primary science observing mode is a three-axis stabilized compound spin

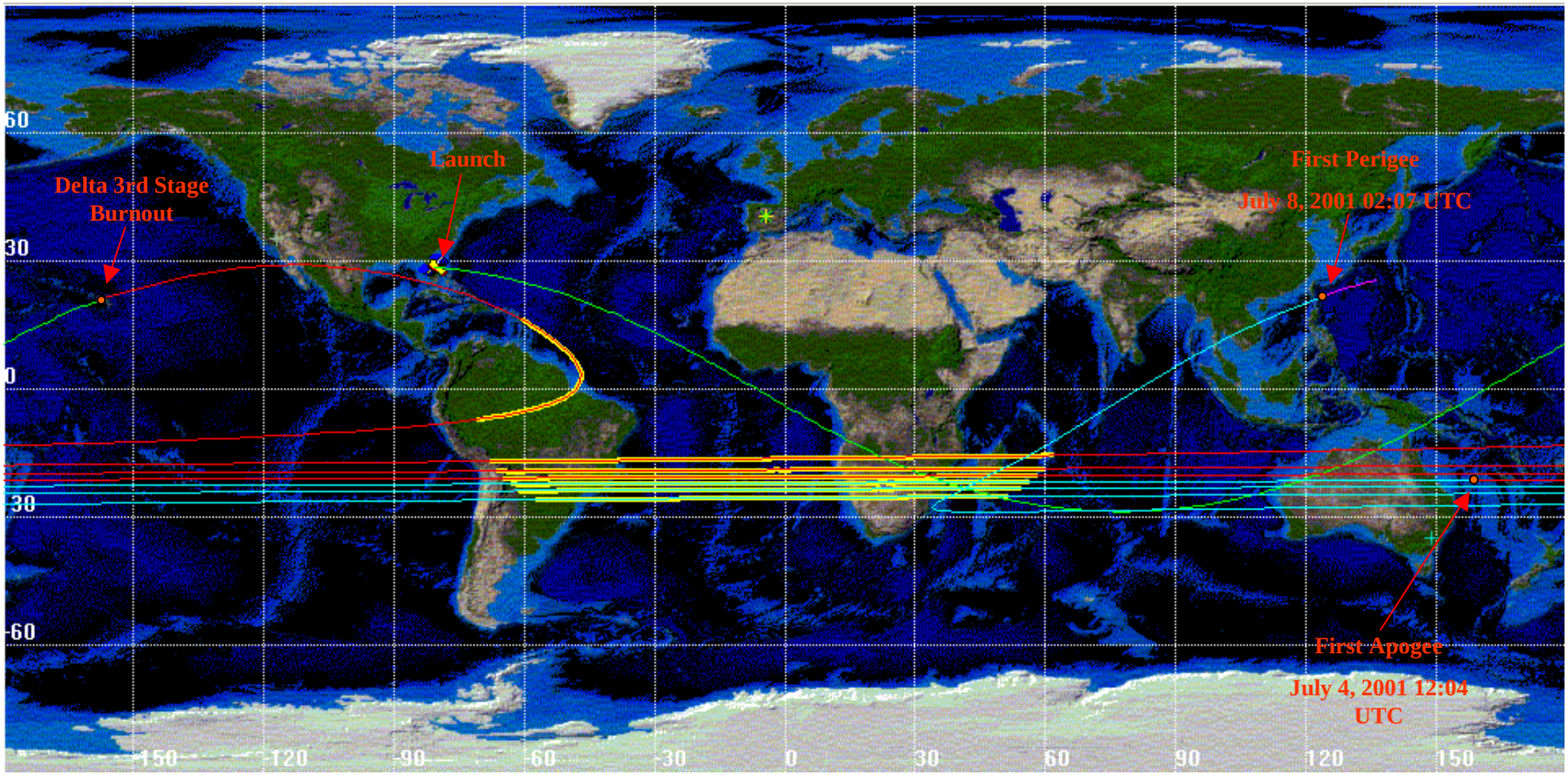


Overview

- The SMOC is at GSFC; Building 3 Room S25, Science Center (OMEGA) is in Building 21
- The Deep Space Network is the primary network
  - Normal Ops supported on the 70m, 37 minute pass/day
  - SN will support launch/separation and the perigee maneuvers
- Four L2 stationkeeping maneuvers and momentum unloads planned per year

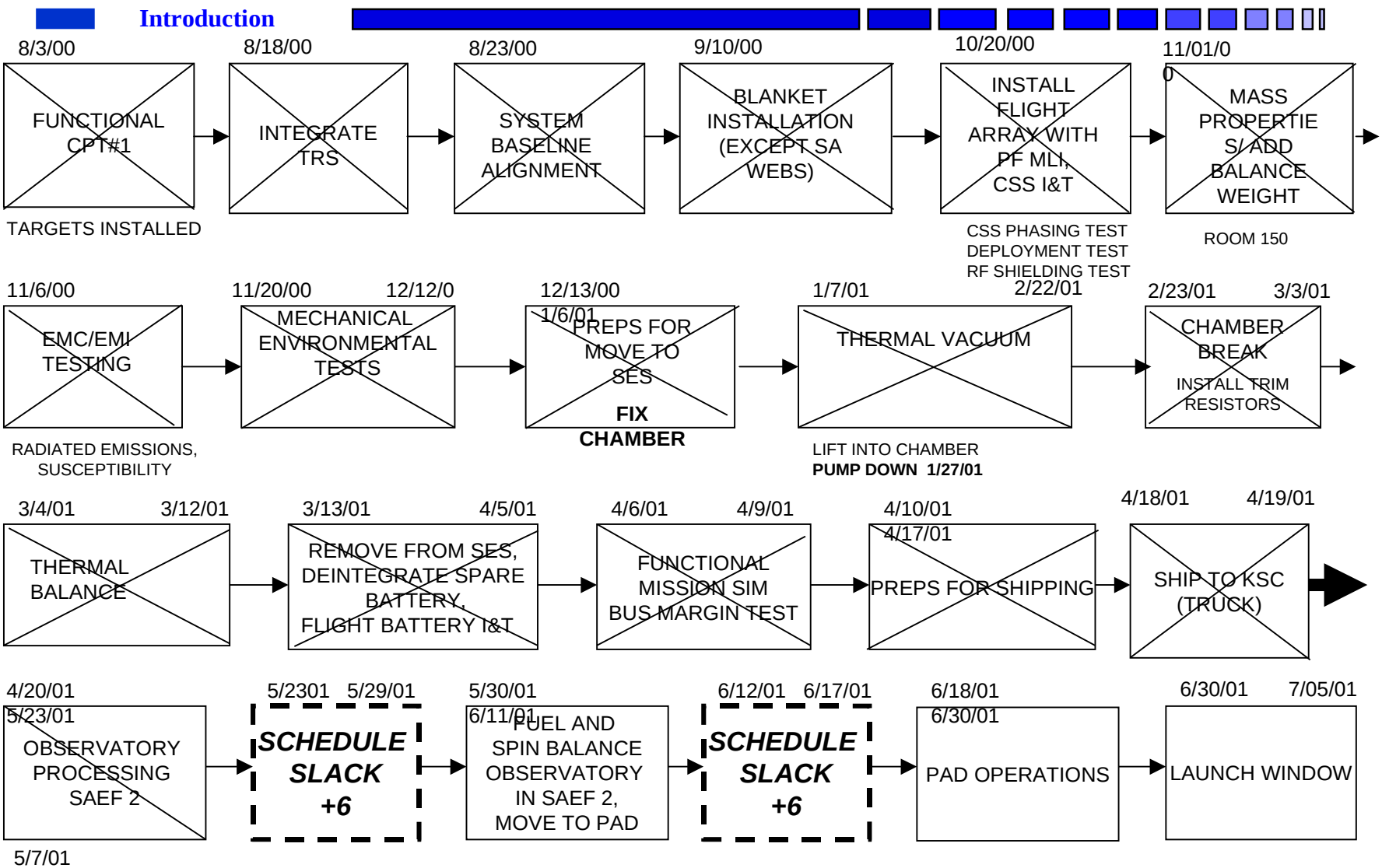
MAP Groundtrack Through First Perigee

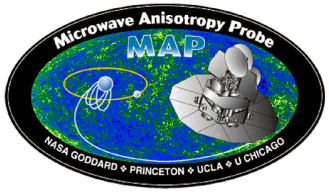
(June 30, 2001 Launch)



Madrid station coverage is shown overlapping the trajectory - assumes a 5° minimum elevation

MAP OBSERVATORY LEVEL TESTING

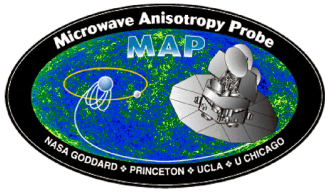




Day-by-day Schedule

May

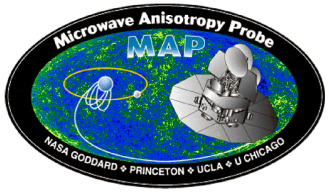
Sun	Mon	Tue	Wed	Thu	Fri	Sat
		1-P • RF checkout with MIL 71 8a.m.-12p.m. • 9 a.m. CPT PR mtg. • contingency procs	**2** • unpowered work (see dailys) (team travels back to GSFC for sim7)	**3** • unpowered work (see dailys)	**4-P** • Mission Sim 7 on S/C @ GSFC (16 Hrs) (Launch -> Deploy and Contingency with SN & DSN) 4 a.m. – 8 p.m. • config for prop test (8 p.m.-12 a.m.)	**5-P(KSC)** • Prop Test (Flt Plugs & Thruster Covers Installed start 7 a.m.- Sun. 11 p.m. • *Mission Sim 2f on flatsat (mid-course correction)*
6-P(KSC) • Prop test estimated completion 11 p.m.	**7-P(GSFC)** • config for Delta V test • prop / ACS Delta V test (12 p.m.- 8p.m.)	**8** • MLI c/o's • demate EGSE (except umb) • integrate GSE plugs • *Mission Sim 7a on Flatsat (Apogee to P1 Maneuvers 24 Hrs)* *7 a.m. start*	**9-P(pots)** • wrap S/A harness • install pots • clean secondaries • manlift ops • power obs./pot verification • *Mission Sim 7a on Flatsat (Apogee to P1 Maneuvers 24 Hrs)*	**10** • clean observatory • deck MLI close out (2 shifts) • ***Mission Sim 7a completes at 7 a.m.***	**11-P3rd** • hinge,thruster alignment • install transition blanket • 3rd shift power up **Ops Readiness Review**	**12** • complete transition MLI • transition blanket RF test • pre-panel final walkdown/ signoff
13-P • install flight panels • Panel electrical integration & light test • thermal knife verification • CSS Phasing Test • 3rd shift power up ?	**14** • Install Solar Array WEB MLI • recondition battery (3 day 24 hr/day) • *Mission Sim 8a on Flatsat (24 Hrs)* *(Launch to Apogee)* *7 a.m. start*	**15** • Install Solar Array WEB MLI & Connectors • recondition battery •*Mission Sim 8a on Flatsat (24 Hrs)* *(Launch to Apogee)*	**16** • Install Solar Array WEB MLI & Connectors • recondition battery • *Mission Sim 8a on flatsat (apogee burn) sim completes 3 p.m.*	**17-P3rd** • Install Solar Array WEB MLI & Connectors • FOV measurement • 3rd shift power up	**18-P3rd** • Perform RF Test and Stow Panels • SA alignment PG • 3rd shift power up	**19-P** • deployment test
20-P • contingency proc testing ? • *Move Flatsat to Bldg 1.*	**21-P(GSFC)** • PAD Functional Dry Run from GSFC	**22-P** • s/c contingency proc testing • **MRR**	**23-P** • Mission Sim 8 on S/C @ GSFC (16Hrs) (Launch with SN & DSN)prop flt plugs in • discharge battery	**24** • demate umb & J339 • Moment Of Inertia Test • **DSN Readiness Review**	**25** • Moment Of Inertia Test	**26** • Schedule Slack • PR c/o • loading preps
27 • Schedule Slack • *Move Flatsat to B1.*	**28** ***Memorial Day*** • Schedule Slack	**29** • Set-up All Cables - GSE/Ground, Cover ORCA Flim	**30** • Load Propellant	**31** • Pressurize		



Day-by-day Schedule

June

Sun	Mon	Tue	Wed	Thu	Fri	Sat
					1 • Monitor Propellant Pressure & Decontaminate • *Move Flatsat to Bldg 1.*	**2** • wet spin balance
3 • wet spin balance	**4** • wet spin balance *flatsat sim*	**5** • Schedule Slack • post-spin MLI c/o • paperwork c/o	**6** • Schedule Slack • paperwork c/o	**7** • Schedule Slack • charge battery (16 hrs) • paperwork c/o	**8-P** • schedule slack • instrument burn in testing • normal ops sim thru MIL 71 (3 shifts)	**9-P** • schedule slack • instrument burn in testing • normal ops sim thru MIL 71 (3 shifts)
10-P • schedule slack • instrument burn in testing (3 shifts)	**11-P** • instrument burn in testing (3 shifts) *flatsat sim*	**12-P** • instrument burn in testing (2 shifts) • discharge battery • demate EGSE (except battery rack)	**13** • Weigh Spacecraft/3rd Stage Mate Preps • 3rd Stage Uncanning • EGSE to blockhouse	**14** • S/C Mate to 3rd stage	**15** • Clampband Instl/Tensioning •start battery reconditioning ?	**16** • battery reconditioning
17 • battery reconditioning • battery	**18** • 3rd stage & S/C can preps Preps for transport • battery rack to blockhouse *flatsat sim*	**19** Transport to Pad & Spacecraft Erect. Mate (T-9)	**20-P** Battery Charging (35 Hours) (T-8)	**21-P** Spacecraft Testing • pre-fairing pad functional (T-7)	**22-P** Flt. Verification & Power on Stray Voltage (T-6) Launch & Contingency DEMO on S/C	**23-P** Spacecraft testing
24-P Spacecraft testing	**25-P** Pwr Off Stray Volt., Ordnance, Inst & Hookup (T-5)	**26-P** Fairing Installation (T-4)	**27-P** Fairing Finaling Prop Load Preps post-fairing A-side functional test (T-3)	**28-P** Second Stage Propellant Loading (T-2)	**29-P** Beacon, Range Safety, & Class A Ordnance (T-1)	**30-P** Launch



Mission Operations Status

Element	Status
Flight Software Maintenance	**Ready**
Science Operation & Data Processing	**Ready**
Ground System	**Ready**
Launch and IOC Ops Preps	L&IOC timelines and scripts are complete, all ops procs are tested or signed pending test. Complete 5/23
Networks	DSN: **Ready**, ORT testing continues. TDRSS: **Ready**, Mila Relay testing continues
Trajectory and Navigation	**Ready**: Trajectory to ground ICD needs minor cleanup and signature
Planning, Trending and L0 Processing	**Ready**
Training and Sim Preps of Ops Personnel	Team is in place; Systems and SS have participated in all Sims, SCT certification complete. 29 of 43 Sims complete

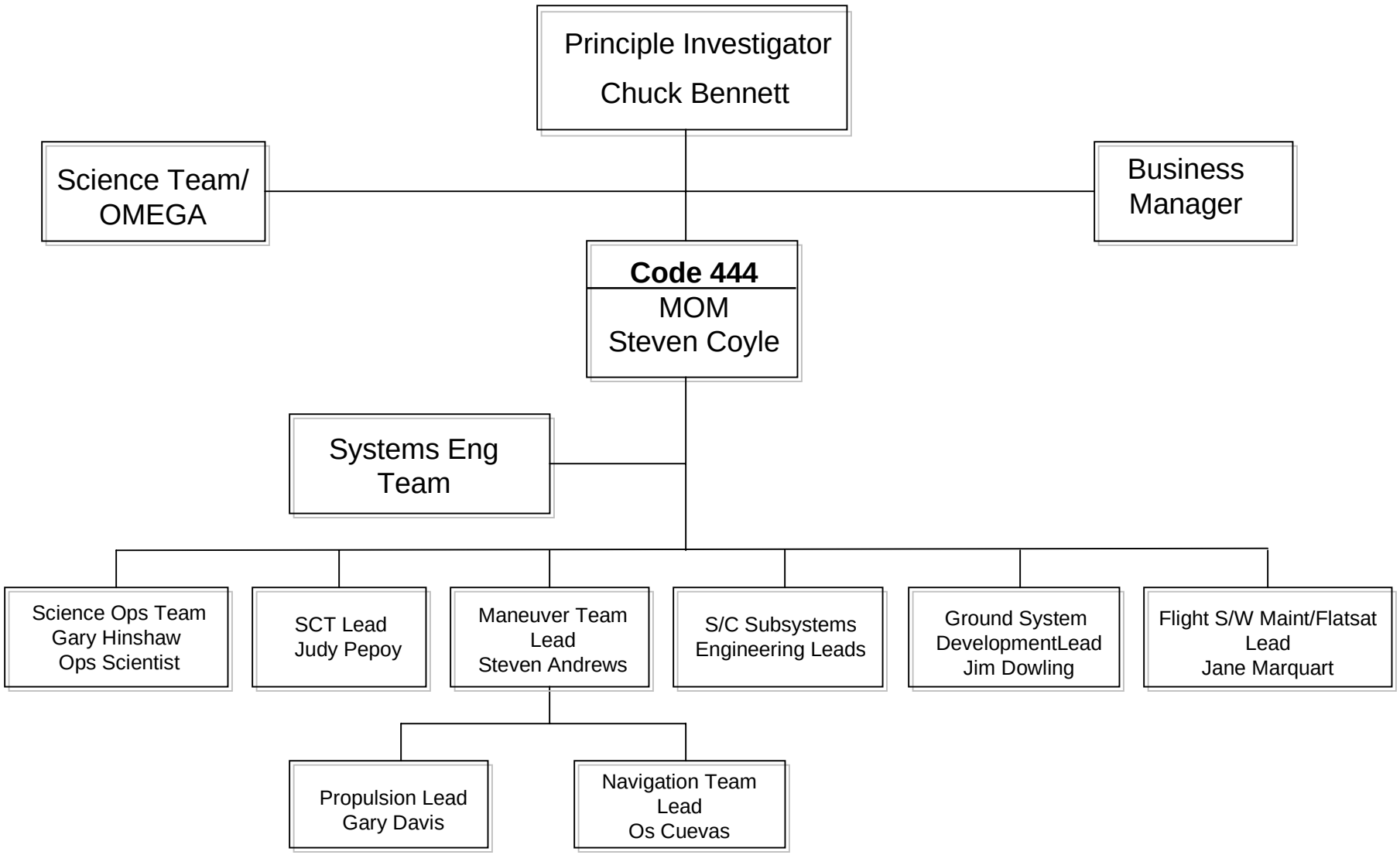
Ground System & Operations Reviews

• Ground System Design Review	Code 300
• Confirmation Review	HQ
• Operations Peer Review	External
• Critical Design Review	Code 300
• Trajectory Review	External
• Flight Operations Review	Code 300
• Delta-Trajectory Review	External
• Red Team Phase I	Center
• Operations Retreat	Internal
• Pre-Ship Review	Code 300
• Red Team Review Phase II	Center
• **Operations Readiness Review**	**Code 300**

Review Recommendation Status

- All Actions and Recommendations from all the Reviews have been **CLOSED**

Phase E Organization Chart



Roles and Responsibilities

- **Principal Investigator** (Chuck Bennett) - Overall responsible for the execution of the MAP mission. Co-chair of the on-orbit CCB.
- **Science Team** (Gary Hinshaw) - Responsible for scientific operations of the MAP mission
- **Mission Operations Manager** - Responsible for the overall operations of the MAP mission, which includes health and safety. Manage the SCT. Co-chair of the on-orbit CCB.
- **Spacecraft Controller Team** - Responsible for all aspects and duties associated with mission operations.

Roles and Responsibilities

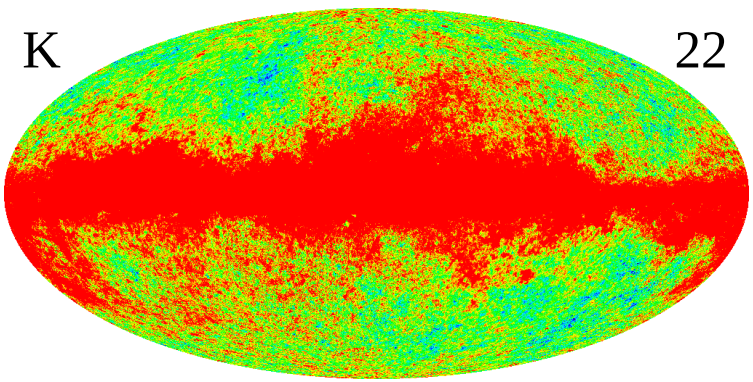
- **Maneuver Team -** Responsible for the design and maintenance of the MAP trajectory through all mission phases.
- **Subsystem Engineers -** Directly responsible for their given subsystem until successful in-orbit checkout. Available, as needed, for consultation in the event of any anomaly. Periodically, evaluate subsystem performance based on trend reports generated by the SCT.
- **Systems Engineers -** Responsible for the overall observatory performance. Coordinate subsystem support during IOC. Available, as needed, for consultation in the event of any anomaly. Periodically, evaluate subsystem performance based on trend reports generated by the SCT.

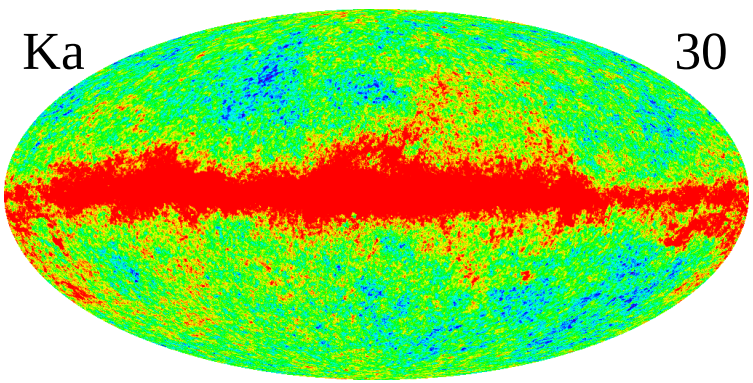
Science Operations Status

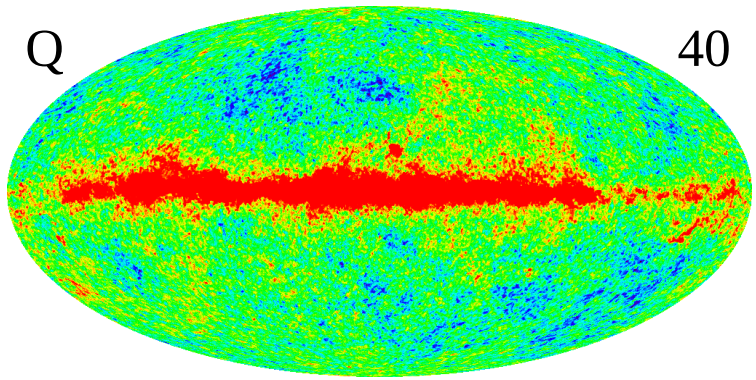
Gary Hinshaw

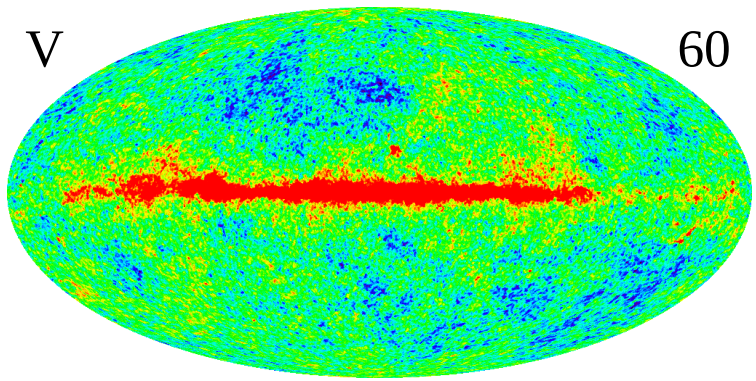
MAP Primary Data Products

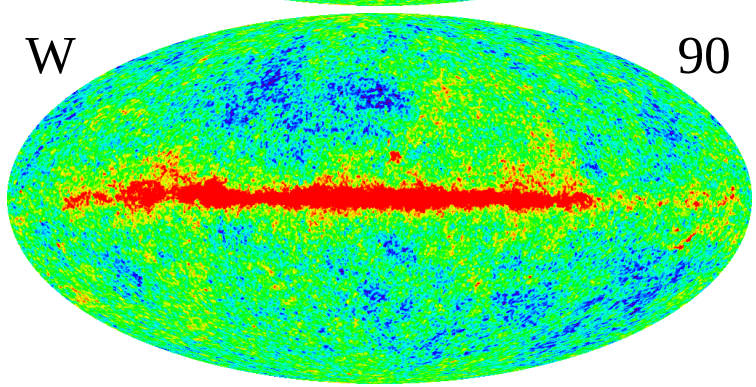
Science Operations Status









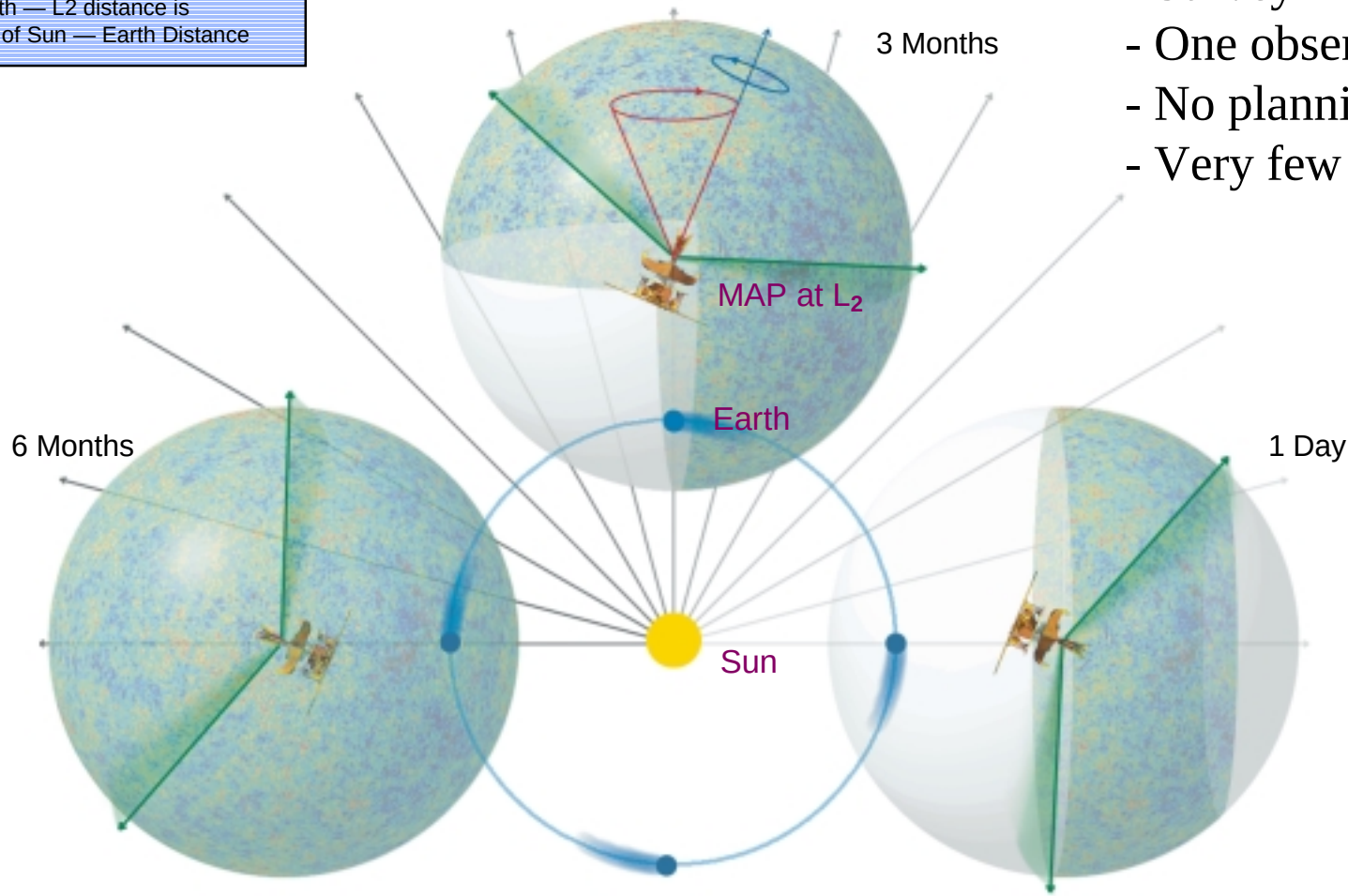


MAP Science Operations

Science Operations Status

Not to scale:
Earth — L2 distance is
1% of Sun — Earth Distance

- Survey mission
- One observing mode
- No planning
- Very few commands



Science Data Flow

Science Operations Status

SMOC (Building 3)

Uncompressed Science

Instrument Housekeeping

Spacecraft Housekeeping

Page Displays

WWW

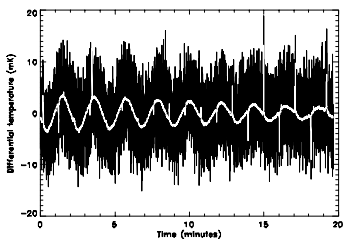
Uncompressed Science

Instrument Housekeeping

Spacecraft Housekeeping

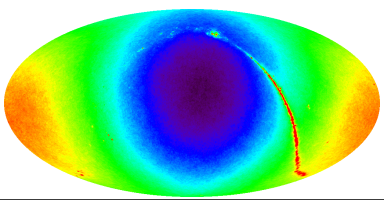
Preprocessor

OMEGA (Building 21)



Science Data Archive

Calibration & Mapping



Calibrated Sky Maps

ftp as needed
OMEGA to Science Team

Science Team Institutions

Calibrated Sky Map Copies

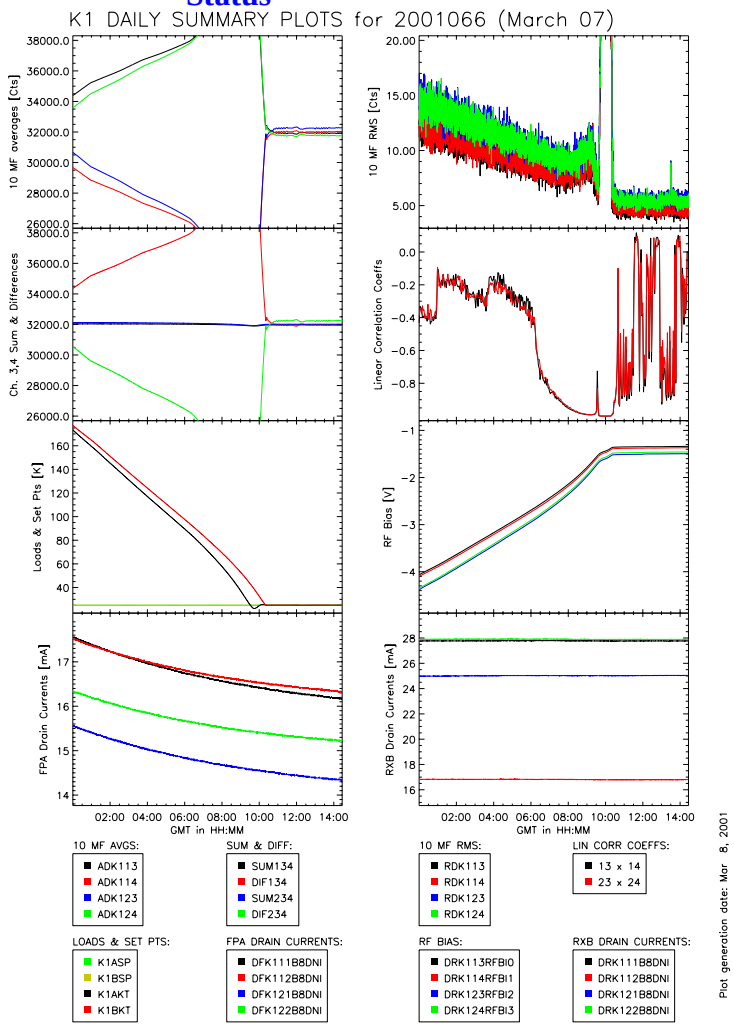
Data flow:

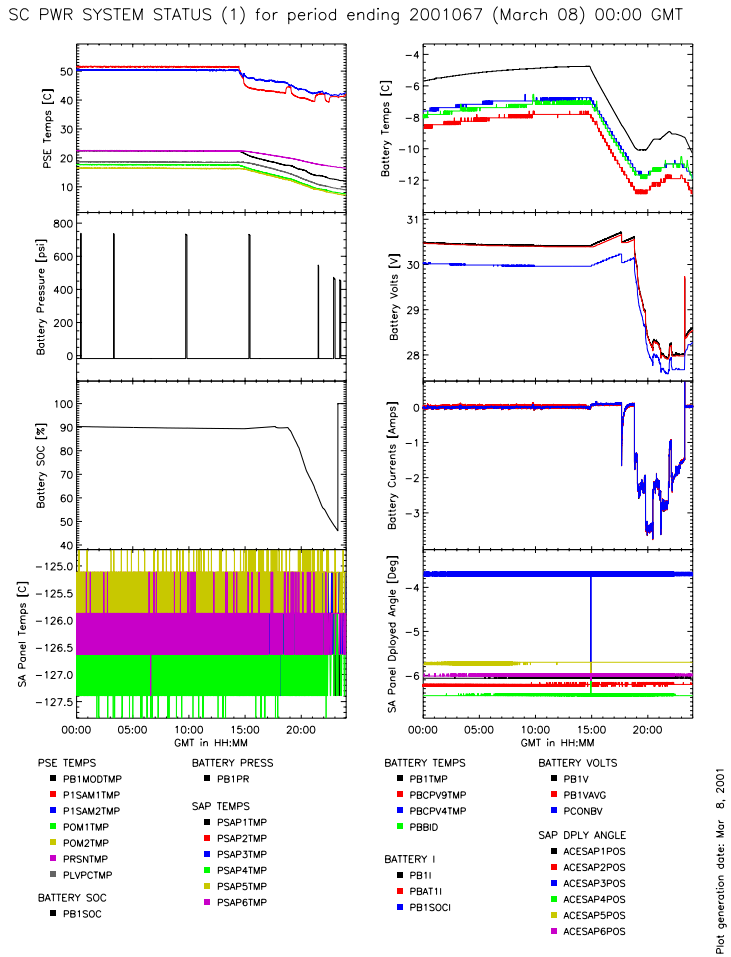
SMOC to OMEGA:
ftp level-zero files daily

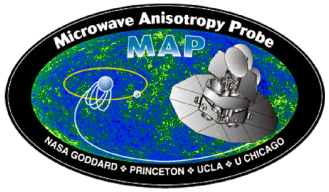
OMEGA to Science Team:
ftp sky maps, etc. as needed

Sample Page Displays

Science Operations Status

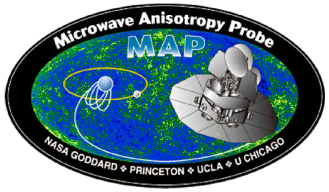






Role of Operations Scientist

- Represent the MAP Science Team in operations related matters
- Interface between the SMOC and OMEGA
- Oversee monitoring of MAP instrument health and safety during critical operations, eg. launch and maneuvers
- Support staff located in MAR (across hall from SMOC) and in OMEGA (Building 21). Both sites on VOX.



Role of OMEGA

- "OMEGA": ***O***ffice of the ***M***AP ***E***xperiment ***G***eneral ***A***rchive
- Data analysis only, no mission operations responsibility
- Support I&T data analysis
- Develop and maintain MAP Science Data Archive during the life of the mission
- Write and maintain science data processing software
- Produce and verify calibrated sky maps and ancillary data
  - Analyze maps for systematic errors - the *heart* of the job
- Deliver calibrated and corrected maps and ancillary data to NSSDC for public dissemination

OMEGA Overview- 5/01

Science Operations Status

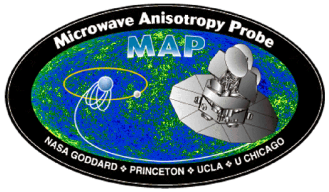
- omega:
  - Model 4100 Dec alpha inherited from COBE, 4 400 MHz cpu, 1 GB ram,
  - access: telnet, ftp, http, ssh
- cmb:
  - sgi Origins 2000, 16 400 MHz cpu, 32 GB ram
  - access: ftp, ssh
- file systems/disk space:

– /home, /omega:	science team, work area	185 GB (36%)
– /map/files:	code, documentation, reference	103 GB (23%)
– /map/data:	data: sims, ground, flight	1 TB (15%)

- personnel
  - 3 FTE programmer/analysts (MG is part-time sys-admin)
  - 0.5 FTE hardware support

Science Data Products

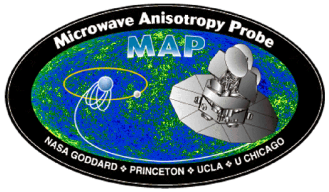
- 30 calibrated sky maps of CMB anisotropy
  - 3 maps for each of 10 DAs
    - 3 maps: 1 temperature and 2 polarization (Stokes: I, Q, U)
    - 10 DAs: 1 @ 22 GHz (K), 1 @ 30 GHz (Ka), 2 @ 40 GHz (Q), 2 @ 60 GHz (V), 4 @ 90 GHz (W)
  - 3,145,728 pixels per map
- Master archive of temperature differences
  - ~35 GB of data per year
- Ancillary data sets for each differencing assembly (DA)



Science Pipeline Readiness

Science Operations Status

- The science team is ready to support science operations.
- The science data processing pipeline is ready to support flight data analysis, including:
  - Calibration and map-making
  - Systematic error analysis



Sky Map Analysis Status

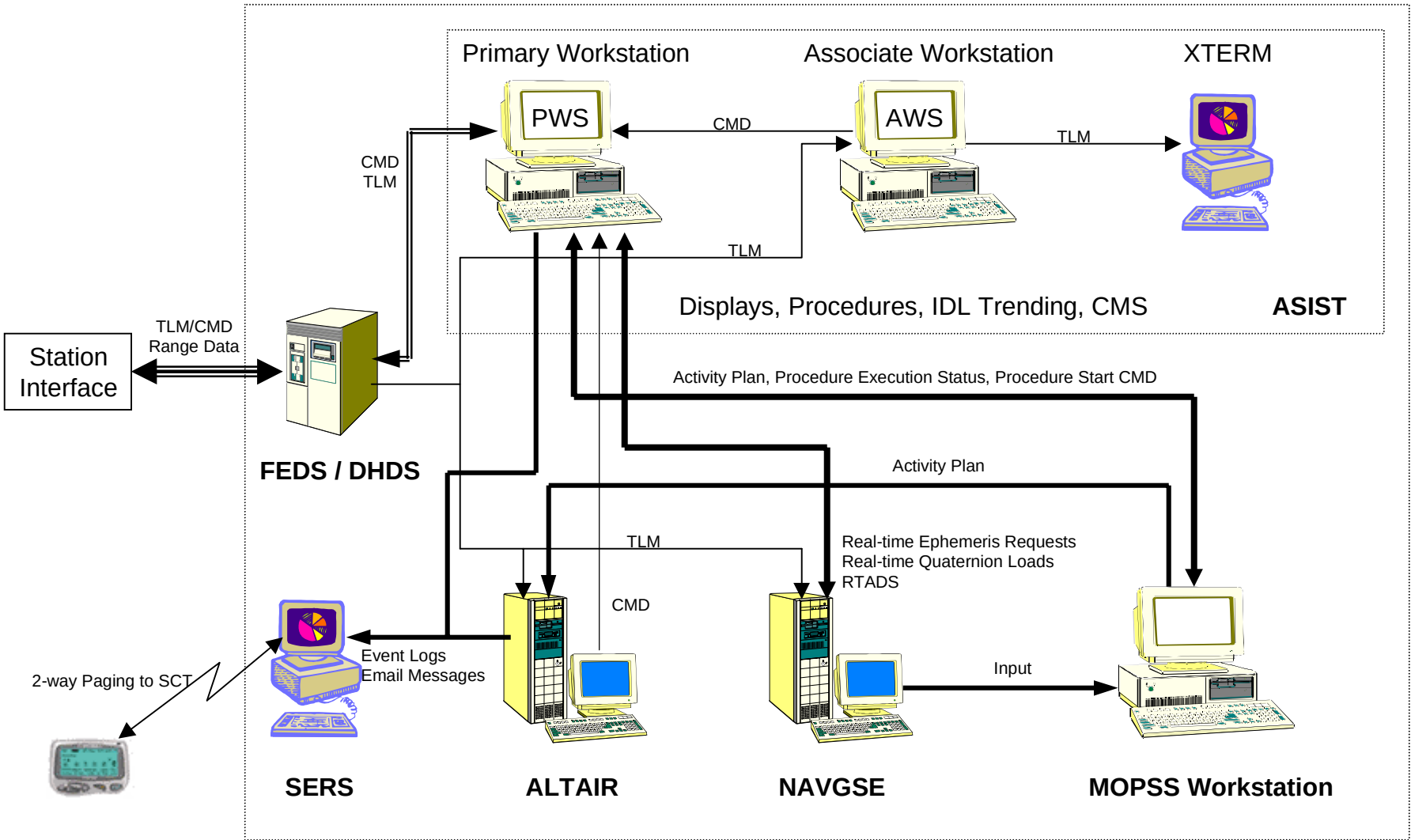
- Code to compute angular power spectra from calibrated sky maps.
  - Code to analyze a single frequency map exists and demonstrates major elements of the algorithm.
  - Code for simultaneously analyzing multi-frequency maps is near completion.
  - Code for analyzing power spectrum of the polarization has been prototyped.

Ground Systems Status

Steven Coyle

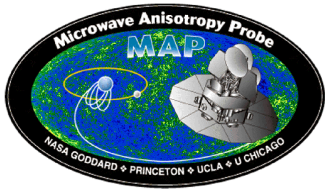
Combined Ground System Diagram

Ground Systems Status



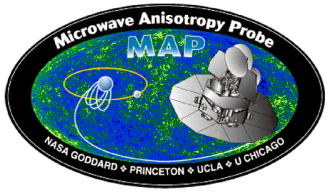
Change Since the FOR

- Integrated the Science Team's near realtime plotting tool (Mini OMEGA) into the SMOC.
  - System and Interface is operational and run throughout Instrument I&T
  - Mini OMEGA has a canned set of near realtime trend plots and post them to the web
  - Mini OMEGA is an offline, standalone, non-critical system for launch



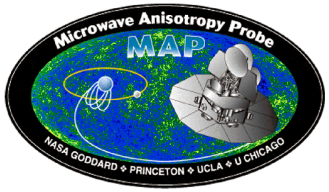
Ground System Status

- Common Ground System that is Operational in the IMAGE and EO-1 control centers
- Running ASIST Release 9.0f
  - Launch Release, Delivered 2/15/01
  - No Launch Critical UPR's outstanding
  - No Project level PFR's
- Ground System is Frozen L-60 days
  - April 30, 2001



Security

- Documentation
  - Security Mgr. - Steven Coyle, Security Officer - Kevin Blahut
  - Security Plan, Risk Management Plan and Contingency Plan signed
  - IOnet Closed & Open Checklists submitted
  - Authorization to Process letter signed and issued
  - Waivers submitted and signed
- Connectivity
  - No network connectivity exists between SAEF-2 and MAP SMOC, needed by April 24.
  - Secure Gateway rules submitted and approved
  - first scan completed on MAP SMOC, MITOC and MAP TCC
  - Second scan for SMOC planned for 2nd week in May
  - Second scan for TCC @ KSC contingent on connectivity, to be conducted remotely by IP NOC, planned for April 23rd

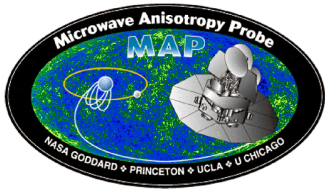


Ground System Readiness

- Ground System is **Ready** for Launch

DSN Readiness

Allen Berman



AGENDA

- PROJECT REQUIREMENTS AND DSN COMMITMENTS PROCESS
- DSN OPERATIONS STATUS
- DSN SCHEDULING
- DSN REVIEWS AND BRIEFINGS
- DSN READINESS STATEMENT

PROJECT REQUIREMENTS AND DSN COMMITMENTS PROCESS

DSN Readiness

- **MAP DETAILED MISSION REQUIREMENTS [DMR] DOCUMENT APPROVED IN 1999**
  - **MINOR UPDATE TO DMR (*ADDENDUM*) APPROVED IN 2001**
- **MAP OPERATIONS AGREEMENT (PROJECT/TMOD/ CSOC) APPROVED IN 2001**

DSN OPERATIONS STATUS DOCUMENTATION

- NETWORK OPERATIONS PLAN (NOP)
  - DRAFT NOP DISTRIBUTED TO SITES AND NOCC FOR REVIEW AND USE IN MSTA PROGRAM JANUARY 12, 2001
  - INCLUDED IN NOP
    - DSN CONFIGURATION
    - SUPPORT PLAN
      - ATTENDED SUPPORTS
      - UNATTENDED SUPPORTS
    - TEST AND TRAINING PLAN
    - INITIAL ACQUISITION PLAN AND PROCEDURES
  - FINAL NOP DISTRIBUTED MAY 11, 2001

DSN OPERATIONS STATUS DOCUMENTATION (CONT)

- **INITIAL ACQUISITION PLAN (IAP) KEY SECTION OF NOP FOR LAUNCH**
  - **ANALYSIS/PLANNING UNDERWAY**
  - **INITIAL PLAN TO BE DISTRIBUTED FOR REVIEW MAY 1, 2001**
  - **FINAL PLAN TO BE PUBLISHED JUNE 1, 2001**

DSN OPERATIONS STATUS
SUPPORTING STATIONS

DSN Readiness

- **GOLDSTONE DSCC**
  - **DSS-16 ---------- 26-METER [1]**
  - **DSS-27 ---------- 34-METER HIGH-SPEED [2]**
  - **DSS-24 ---------- 34-METER BWG**
  - **DSS-14 ----------70-METER**
- **CANBERRA DSCC**
  - **DSS-46 ---------- 26-METER [1]**
  - **DSS-34 ---------- 34-METER BWG**
  - **DSS-43 ---------- 70-METER**
- **MADRID DSCC**
  - **DSS-66 ---------- 26-METER [1]**
  - **DSS-54 ---------- 34-METER BWG**
  - **DSS-63 ---------- 70-METER**

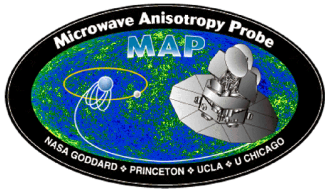
NOTES:

1. **LEOP and Lunar Phasing will be with the legacy system. The automation system will not be available for supporting MAP**
2. **[Pre] Initial Acquisition only**

DSN OPERATIONS STATUS
DSN CONFIGURATION

DSN Readiness

- **TELEMETRY**
  - ON SITE MCD DECODING AND FRAME SYNCHRONIZATION
  - REAL TIME VC'S ARE FORMATTED INTO SFDU DATA BLOCKS AND TRANSMITTED TO THE MAP PROJECT IN REAL TIME
  - PLAY BACK VC'S ARE FORMATTED INTO SFDU DATA BLOCKS AND TRANSMITTED TO THE CDR FOR A POST PASS FTP TRANSMISSION TO PROJECT
- **TRACKING**
  - 26M STATIONS WILL PROVIDE DOPPLER, RANGE, AND ANGLE DATA
  - 34M AND 70M STATIONS WILL PROVIDE DOPPLER AND RANGE DATA
  - ALL TRACKING DATA WILL BE SENT TO FDF, AND TO MAP'S SMOC
- **COMMAND**
  - MAP WILL USE THROUGHPUT COMMANDING
- **MONITOR**
  - MONITOR 5-15 DATA WILL BE PROVIDED FROM THE NOCC-RT TO MAP SMOC



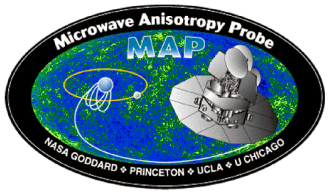
DSN OPERATIONS STATUS
TEST AND TRAINING

DSN Readiness

- **END TO END DATA FLOW COMPLETED FEBRUARY**
- **MISSION SERVICES TRAINING OF STATIONS TO DATE**
  - **PHASE 1 –DSN INTERNAL -- COMPLETE**
    - **STARTED IN JANUARY AND WAS COMPLETED IN APRIL.**
    - **OBJECTIVE WAS TO TRAIN DSN PERSONNEL IN MISSION SPECIFIC ACTIVITIES, PROCEDURES, CAPABILITIES, AND CONSTRAINTS TO ENSURE DSN READINESS TO SUPPORT PROJECT REQUIREMENTS.**
    - **PROJECT PARTICIPATION STARTED IN MARCH**
  - **PHASE 2 - PROJECT REQUIRED PARTICIPATION**
    - **STARTED IN APRIL AND TO BE COMPLETED BY LAUNCH**
    - **SUPPORT PROJECT LEVEL TEST AND TRAINING ACTIVITIES SUCH AS MISSION SIMULATIONS, LAUNCH SIMULATIONS, MISSION OPERATIONS DATA FLOWS, AND END-TO-END VERIFICATION CHECKS**

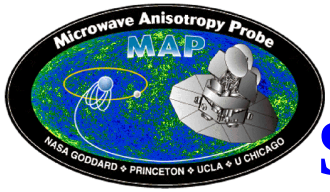
DSN OPERATIONS STATUS
TEST AND TRAINING (CONT)

- PLANS
  - WEEKLY TELECOM WITH PROJECT POCC/FOT
  - PLANS INCLUDE
    - NETWORK COOPERATION/INTERFACING
      - SUPPORT SCENARIO
      - MISSION PROFILES
    - TEST PLANNING AND RESULTS
      - GROUND DATA SYSTEMS TESTING (GDST)
      - OPS READINESS TESTING (ORT)
      - MISSION SIMS
      - LAUNCH SIMS
  - SCHEDULE BEING WORKED



DSN OPERATIONS STATUS
MAP/DSN INTERFACES & COMPATIBILITY

- **DATA SYSTEM INTERFACES ALL SUCCESSFULLY TESTED AND VERIFIED**
  - COMMAND
  - TELEMETRY
  - TRACKING
  - MONITOR
  - SCHEDULING
  - CENTRAL DATA RECORDER (CDR)
  - GROUND COMMUNICATIONS FACILITY (GCF)
- **SPACECRAFT/DSN COMPATIBILITY SUCCESSFULLY DEMONSTRATED**
  - RADIO FREQUENCY INTERFACE
  - COMMAND
  - TELEMETRY
  - RANGING
  - MISSION SUPPORT OPERATING PARAMETER RANGES



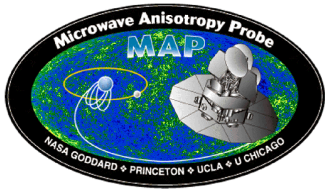
DSN OPERATIONS STATUS
SUPPORT PLAN FOR LAUNCH/LEOP

DSN Readiness

- NETWORK CONFIGURATION CONTROL
  - LAUNCH -JUNE 27, 2001 THROUGH JULY 9, 2001
  - LUNAR FLYBY -JULY 25 THROUGH JULY 31
- CRITICAL POWER COVERAGE FOR THE DSN
  - FOR INITIAL ACQUISITION (L-4 HRS TO L+4 HRS)
  - DURING SCHEDULED ROLLING BLACK OUTS
- SPECIAL NISN COVERAGE
  - L-4 HRS TO L+1 DAY
- RADIO FREQUENCY INTERFERENCE RESTRICTIONS IN PLACE
- SCHEDULING
  - DSN SCHEDULING TO PROVIDE LAUNCH SLIP CONTINGENCIES

DSN OPERATIONS STATUS
SUPPORT PLAN FOR LAUNCH/LEOP (CONT)

- **DSN SUPPORT TEAM**
  - **NOPE ON HAND FOR CRITICAL ACTIVITY STARTING -4 HOURS TO +8 HRS OF ACTIVITY**
  - **INITIAL ACQ SPECIALIST ON-HAND L-4 HRS TO L+8 HRS**
  - **ADVISORS ON HAND L-4 HOURS TO L+8 HRS/**
- **NETWORK MESSAGE**
  - **NOPE WILL PUBLISH NETWORK SUPPORT PLAN L-1 WEEK**
  - **NOPE WILL PUBLISH NETWORK BRIEFING MESSAGE L-3 DAYS**



DSN SCHEDULING

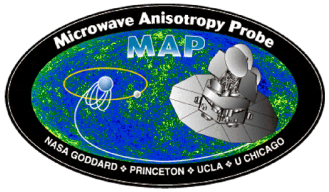
- MAP DSN SCHEDULING STATUS
  - LAUNCH AND LEOP COVERAGE NEGOTIATED AND CONFLICT FREE THROUGH JULY 29, 2001
    - CRITICAL SUPPORT (TWO STATION COVERAGE)
      - LAUNCH - JUNE 30: GOLDSTONE 26M SCHEDULED AS BACKUP TO TDRS. MADRID TWO STATION COVERAGE, 26M DESIGNATED AS PRIME, SCHEDULED FOR DSN INITIAL ACQUISITION PLUS 13 HOURS
      - PERIGEE 1 MANEUVER - JULY 8: GOLDSTONE 26M PRIME, 4 HOURS 34M COVERAGE
      - PERIGEE 2 MANEUVER - JULY 17: GOLDSTONE 26M PRIME, 7 HOURS 34M COVERAGE
      - PERIGEE 3 MANEUVER - JULY 26: GOLDSTONE 26M PRIME, 6.5 HOURS 34M COVERAGE

DSN SCHEDULING (CONT)

- MAP DSN SCHEDULING STATUS
  - LAUNCH CONTINGENCY SCHEDULING PLAN
    - 24 AND 48 HOUR CONTINGENCY SCHEDULE WILL BE BUILT AND PROVIDED TO DSN SCHEDULING AT L-5 DAYS
      - REQUIRES DELIVERY OF VIEWPERIOD FILES AT L-7 DAYS
      - MAP SCHEDULING REPRESENTATIVE WILL BE ON STAFF DURING LAUNCH TO CONFIRM ACCURACY OF NEW SCHEDULES AS REQUIRED

DSN REVIEWS AND BRIEFINGS

- **DSN COMPLEXES GIVEN DETAILED MAP PRE-LAUNCH BRIEFINGS**
  - **MADRID -- MARCH 2001**
  - **CANBERRA -- APRIL 2001**
  - **GOLDSTONE -- MAY 2001**
- **MAP DSN LAUNCH READINESS REVIEW TO BE HELD AT JPL ON MAY 24, 2001**
  - **STEVE COYLE EXPECTED TO ATTEND**



DSN READINESS STATEMENT

- **THE DSN IS FULLY PREPARED TO SUCCESSFULLY SUPPORT THE MAP LAUNCH PHASE, AND THE REMAINDER OF THE MAP MISSION**

SN Readiness

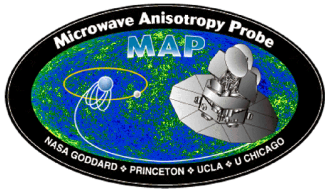
Tom Bialas

SN Requirements

- The Space Network (SN) will provide communications coverage during MAP near-earth critical operations where the DSN does not have a view; separation and perigee maneuvers
- 2 Kbps telemetry, 2 Kbps commanding & one and two-way doppler data
- Ground transport via the WDISC IP network

MAP - TDRSS Interface Heritage

- MAP SMOC - WDISC Interface Heritage
  - SMOC - WDISC Cmd Interface Identical to EO1
  - WDISC - SMOC Tlm Interface Nearly Identical to EO1
- MAP S/C - TDRS Interface Heritage
  - MAP Transponders Identical to EO1, FUSE



Interface Tests Performed

- 12/22/98 End to End, 2 TDRSS Events
  - Tlm Only
- 8/16/99 End to End, 2 TDRSS Events
  - Tlm Only
- 2/2/01 WDISC Connectivity test
  - Firewall/Network Checkout
  - Tlm and Cmds
- 3/12/01 End to End, 4 TDRSS Events
  - Tlm and Cmds,
  - PTP Switch and Feds Cmd Switch

Interface Tests Performed (Cont..)

- 4/8/01 Launch Sim, 3 TDRSS Events
  - Tlm and Cmds
  - PTP Switch and FEDS Cmd Switch
  - Coherent/non-Coherent Passes, GCMRs
- 5/4/01 Launch Sim with MILA Relay, 5 TDRSS Events
  - Tlm and Cmds
  - PTP Switch and FEDS Cmd Switch
  - TDRSS(MILA) to DSN (MIL71) Handover
  - DSN (MIL71) to TDRSS(MILA) Handover

Summary

- MAP-TDRSS Cmd, Tlm, and Control Interfaces have been Tested and Verified.
- MAP-TDRSS RF Compatibility has been Tested and Verified
- MAP-TDRSS Interface is Ready to Support Launch and Operations

Mission Timelines

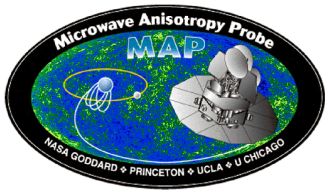
Steven Coyle
Bruce Twambly
Stephen Andrews

Launch Countdown Summary

Power-On Shift

Mission Timelines

Planned Activity for Nominal Launch - June 30, 2001	GMT (hh:mm:ss)	EDT (hh:mm:ss)	L- Time (hh:mm)	T-Time (hh:mm)
Configure & verify MAP Ground Segment for Launch Operations	7:56:46	3:56:46	11:50	10:40
Call To Station: Remainder of Spacecraft Power-On Team	9:16:46	5:16:46	10:30	9:20
Proceed with Power-On of Spacecraft	9:46:46	5:46:46	10:00	8:50
** MST Preparations and Move	9:49:46	5:49:46	9:57	8:47
GSFC Sys: Handover Primary Control of Spacecraft to GSFC	10:21:46	6:21:46	9:25	8:15
Proceed with Power-On of Instrument	11:16:46	7:16:46	8:30	7:20
Load/verify ACS Tables 48, 51 & 54	11:31:46	7:31:46	8:15	7:05
Load/verify RTSs 30, 31 &150	11:41:46	7:41:46	8:05	6:55
Load/verify Launch Day Ephemeris	11:51:46	7:51:46	7:55	6:45
** MST move completed	12:49:46	8:49:46	6:57	5:47
Configure MV TSMs & ACS FDCs to Launch Configuration	12:56:46	8:56:46	6:50	5:40
Configure RTSs to Launch Configuration	13:26:46	9:26:46	6:20	5:10
** Final Mission Assurance COLA Decision to Boeing	13:46:46	9:46:46	6:00	4:50
Initiate Playback of VRs	13:46:46	9:46:46	6:00	4:50
Set PSE Wheel Timer	15:21:46	11:21:46	4:25	3:15
Turn Off Instrument for Launch	15:26:46	11:26:46	4:20	3:10
Complete Configuration to Basic Launch Configuration	15:31:46	11:31:46	4:15	3:05
Basic MAP Launch Configuration Complete	15:36:46	11:36:46	4:10	3:00
Start of Shift Handover: Power-On to Launch	15:46:46	11:46:46	4:00	2:30
** Start of T-150 (60 minute) Built in Hold	16:06:46	12:06:46	3:40	2:30
Call To Station for Shift Handover: Spacecraft Launch Team	16:16:46	12:16:46	3:30	2:30
** Final Manned Conjunctions to Boeing/NASA Launch Team	16:46:46	12:46:46	3:00	2:30
MAP PM Polls MAP KSC/GSFC to "GO" for Initial Terminal Count	16:46:46	12:46:46	3:00	2:30
*** NLM Polls MAP PM to "GO" for Initial Terminal Count	16:51:46	12:51:46	2:55	2:30

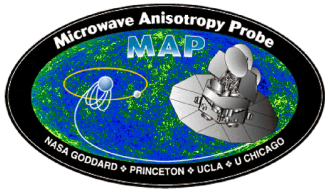


Launch Countdown Summary

Launch Shift

Mission Timelines

Planned Activity for Nominal Launch - June 30, 2001	GMT (hh:mm:ss)	EDT (hh:mm:ss)	L- Time (hh:mm)	T-Time (hh:mm)
** Last access to Umbilical Console	17:06:46	13:06:46	2:40	2:30
** End of 60 minute Built in Hold	17:06:46	13:06:46	2:40	2:30
Shift handover complete	17:06:46	13:06:46	2:40	2:30
Select TDRS Filter Tbl & Command to 2k Downlink	17:36:46	13:36:46	2:10	2:00
MAP PM Polls MAP KSC/GSFC to "GO" for Cryo Loading	17:56:46	13:56:46	1:50	1:40
** Weather Briefing	18:01:46	14:01:46	1:45	1:35
** Winds Assessment Briefing	18:06:46	14:06:46	1:40	1:30
*** NLM Polls MAP PM to "GO" for Cryo Loading	18:09:45	14:09:46	1:37	1:27
** Begin LOX loading	18:21:46	14:21:46	1:25	1:15
** Weather Update	18:57:46	14:57:46	0:49	0:39
** Winds Assessment Update	19:03:46	15:03:46	0:43	0:33
Start RTS 150 & Enable PSE Wheel Timer	19:16:46	15:16:46	0:30	0:20
** Range Status Update	19:21:46	15:21:46	0:25	0:15
** Winds Assessment Update	19:24:46	15:24:46	0:22	0:12
MAP PM Polls MAP KSC/GSFC to "GO" for Final Launch Prep	19:26:46	15:26:46	0:20	0:10
*** NLM Polls MAP PM to "GO" for Final Launch Prep	19:28:46	15:28:46	0:18	0:08
** Start of 10 minute Built in Hold	19:32:46	15:32:46	0:14	0:04
MAP PM Polls MAP KSC/GSFC for "GO/NOGO" for Launch	19:34:46	15:34:46	0:12	0:04
*** NLM Polls MAP PM for "GO/NOGO" for Launch	19:36:46	15:36:46	0:10	0:04
** LCDR to proceed with countdown at the end of the 10 minute hold	19:41:46	15:41:46	0:05	0:04
SAS Off - MAP on Internal Power	19:41:46	15:41:46	0:05	0:04
** End of 10 minute Built in Hold	19:42:46	15:42:46	0:04	0:04
Launch Window Open	19:46:46	15:46:46	0:00	0:00
** "Lift - Off"	19:46:46	15:46:46	0:00	0:00
Launch Window Close	19:56:46	15:56:46	0:00	0:00

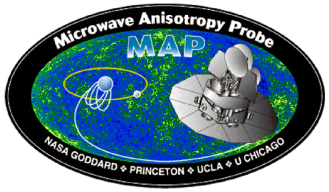


Delta-II Ascent

Launch Sequence		
MET (sec)	**L+TIME**	**Activity Description**
0.000	L + 0:00:00	LAUNCH
696.428	L + 0:11:36	First Cutoff - Stage II (SECO 1)
2936.000	L + 0:48:56	MAP in view of TDRS West
4532.000	L + 1:15:32	MAP Transmitter Turn ON
4663.038	L + 1:17:43	First Restart - Stage II
4667.214	L + 1:17:47	Second Engine Cut Off - Stage II (SECO 2)
4717.214	L + 1:18:37	Fire Spin Rockets
4720.214	L + 1:18:40	Jettison Stage II
4757.214	L + 1:19:17	Stage III Ignition
4845.010	L + 1:20:45	Stage III Burn Out
5127.214	L + 1:25:27	Initiate Yo-Yo Despin
5132.214	L + 1:25:32	Jettison Stage III - MAP SEPARATION
7232.000	L + 2:00:32	MAP Power Positive
7352.000	L + 2:02:32	MAP Stable on the Sunline

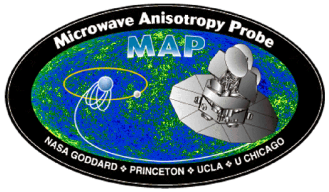
Event Management

- MAP Launch and IOC command activities have been orchestrated in three levels
  - Graphical timelines associate major events with the orbital environment, scheduled communications supports, etc. The timeline spans from pre-launch to L2
  - Text based scripts coordinate the execution of these events by specifying STOL procedures, milestones, coordination callouts, etc. Scripts typically span time periods of several hours to days
  - STOL command procedures execute on the ground system and issues commands to the spacecraft. Procedures typically span several minutes



Graphical Timeline

- The graphical timeline is managed by a home grown utility written and executed in Linux
- Inputs to the utility include
  - Event database (text file)
  - Scheduled communications supports (text file)
  - Predicted ephemeris (code 500 format)
- Perl scripts read the text input, event times, generate “standard” events such as recorder playbacks and creates an intermediate file
- C program reads the ephemeris to derive station view periods and generates the graphical output



Graphical Timeline

- Events are defined in five levels
  - Phase
  - Activity
  - Event
  - Step
  - Detail
- Run time options include
  - Detail level
  - Time per page
  - Time span
  - Output device (X-windows, postscript)

Sample Event Database

Mission Timelines

P----	A+0.000000	0.0	********** IOC **********
-A---	P+0.000000	---	====== Post Separation Config =======
--E--	+0.000000	---	AST Hardware Configuration
---S-	+0.000000	5.0	STOL m2facs_acsconfig("ASTA_ON","ASTB_ON","ALL")
--E--	+0.000000	---	Instrument Power-on
---S-	+0.000000	8.0	STOL m2sdinston("ALL")
---S-	+0.000000	1.0	Enable RTS 66,50,51,52
--E--	+0.000000	---	PSE to VT3 / Trickle Charge to 0.1158
---S-	+0.000000	2.0	STOL m2spsspsevt(3, 0, 0, "ALL")
---S-	+0.000000	1.0	STOL m2spsetrki(0.115, "ALL")
--E--	+0.000000	---	ACS Cleanup
---S-	+0.000000	12.0	STOL m2soacqcleanup("ALL")
---S-	S+0.000000	---	note: Removes fake IRU bias
-A---	>A+0.000000	---	==== Delta-H ====
--E--	+0.000000	---	Contingency - Catbed heaters ON
---S-	+0.000000	2.0	STOL m2balvpcserv("ON","3,4,5,6")
--E--	+0.000000	---	Execute Delta H, repeat as necessary
---S-	+0.000000	26.0	STOL m2macsdeltah("ALL")

High Level Example

- Page 1 from tl_ mission_ v1_ 10.pdf

Mid Level Example

- Page 1 of tl_ day13_ v1_ 10.pdf

Low Level Example

- Page 1 of tl_ burnpf_ v1_ 10.pdf

Maneuver Team

- Representatives from Trajectory, Attitude, Propulsion, Flight Software, Controllers, Navigation
- Responsible for planning, verifying, executing, calibrating, and reconstructing maneuvers
- Will verify maneuver plan and expected performance
- Will run the Command Authorization Meeting (CAM) for all subsystems
  - summarize maneuver plan, discuss timeline, possible contingencies, etc
- Will do maneuver reconstruction

Status

- Trajectory team simulations
  - verified that data can move through the system
  - trained several people to use software and procedures
  - results indicate the planning and simulation tools are consistent
- Project mission simulations
  - shown all data product delivery and use
  - demonstrated the usefulness of the CAM
  - maneuver execution occurs as expected
- Burn reconstuctions and subsequent maneuver planning and execution for burns has been done up to L_2 insertion
  - P1 to Mid Course Correction Maneuver
- Contingency planning is ongoing, and has been exercised in some mission simulations

Maneuver Planning Timelines

Nominal plan

Burn-24h	Orbit Determination done
Burn-23h	Orbit Determination delivered
Burn-20h	Finite Maneuver Plan done
Burn-19h	HiFi, NavGSE done
Burn-16h	FlatSat done
Burn-14h	Verification completed
Burn-13h	Send data to subsystems
Burn-12h	Orbit Determination done
Burn-11h	CAM, Burn-12 hour Orbit Determination delivered
Burn-09h	Finite Maneuver Plan
Burn-08h	**load Burn-24 hour ATS, CQT to spacecraft if okay**
	ATS gets enabled as soon as load is verified

Replanning Timelines

With replan, w/FlatSat (6 hours)

Burn-08h	HiFi, NavGSE done
Burn-05h	FlatSat done
Burn-04h	Verification
Burn-03h	CAM
Burn-02h	load Burn-12 hour files to spacecraft
Burn-02h	**ATS gets enabled as soon as load is verified**

With replan, w/o FlatSat (3 hours)

Burn-08h	HiFi, NavGSE done
Burn-07h	Verification
Burn-06h	CAM
Burn-05h	load Burn-12 hour files to spacecraft
Burn-05h	**ATS gets enabled as soon as load is verified**

With replan, w/o FlatSat, w/o HiFi (3 hours)

Burn-08h	NavGSE done
Burn-07h	Verification
Burn-06h	CAM
Burn-05h	load Burn-12 hour files to spacecraft
Burn-05h	**ATS gets enabled as soon as load is verified**

Contingency Recovery

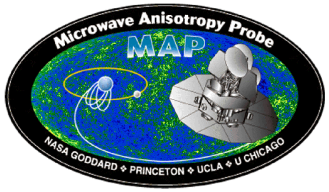
- Finish/makeup maneuver with no Orbit Determination input
  - Recover to Inertial Mode, with proper s/c configuration for burn
    - minutes to hours
  - Command burn ASAP after recovery for
    - (initial command - burn part completed) duration
    - precalculated duration based on % complete / delay / abort
- Finish/makeup maneuver with Orbit Determination input
  - Finite Maneuver Plan
    - hours to days
  - Recover to Inertial Mode, with proper s/c configuration for burn
  - Command burn based on new maneuver plan

Mission Operations Status

Steven Coyle

Bruce Twambly

Peter Gonzales



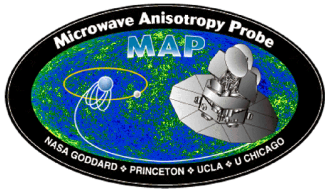
Mission Operations Status Agenda

- Mission Readiness Testing (Coyle)
  - MRT Status
  - Spacecraft Runtime
  - Simulations
- Configuration Management (Twambly)
- Procedure Development (Twambly)
- Contingencies (Gonzales)
- Staffing, Facilities & Launch Management (Coyle)
- Training (Coyle)

DMR Requirements
Test Verification Matrix

Mission Operations Status

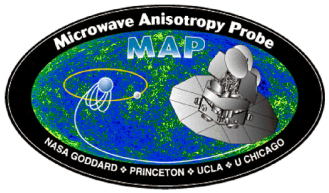
Test Category	Total	Passed	Failed	To be Tested	%Passed	%Failed	%To be Tested
ASIST/FEDS	235	235	0	0	100%	0%	0%
Facilities	6	6	0	0	100%	0%	0%
Launch Support	2	2	0	0	100%	0%	0%
FD/FDF	41	41	0	0	100%	0%	0%
DSN/SN	50	50	0	0	100%	0%	0%
CMS/Mission Planning	112	112	0	0	100%	0%	0%
DPS/ Sci Interface	13	13	0	0	100%	0%	0%
MRT	29	29	0	0	100%	0%	0%
CGS Hardware	10	10	0	0	100%	0%	0%
GSE	2	2	0	0	100%	0%	0%
TOTAL	500	500	0	0	100%	0	0



Observatory Level
Box Runtime

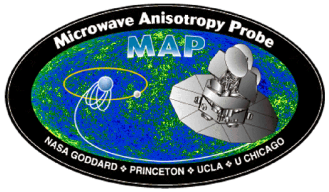
Component	hhhh:mm	Component	hhhh:mm
PSE	4168:07	CATBEDS 1&2	8:58
MAC	4067:26	CATBEDS 3&4	8:56
XPNDR A (RCV)	3966:08	CATBEDS 5&6	9:23
XMITTER A	1167:21	CATBEDS 7&8	9:23
XPNDR B (RCV)	3963:31	DSS	1950:22
XMITTER B	393:52	ISO-VALVE	208:25
XPNDR HTR	142:03	TARA1	1908:17
ST1	1115:58	TARA2	1919:28
ST2	1063:15	INST	2194:04

As of May 5,2001



Mission Simulations

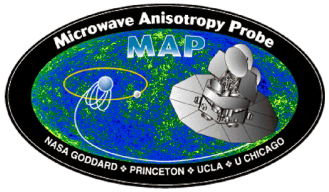
Mission Sim	Date	Status	WOA / PRs Open	Platform	Script Lead / Contingency Lead	Scope	Results
ETE#2	8/10/99	Complete	719/ 35 Closed			End to End with DSN Data flows and clock correlation	
1		Complete		S/C / SMOC		1) 3 Days Nominal L2	
						2) 1 Day TDRSS Downlink ETE	
2	Feb 22-25, 2000	Complete	1172/ 18 Closed	S/C / SMOC		1) 1 Day Launch (sep --> dep --> acq --> Hi Tipoff --> Delta H)	Navgse was not available, workaround exercised
				Flatsat / SMOC		2) 3 Days IOC (checkout, perigee maneuver, L2 nominal auto w/ MOPSS	Post Sep momentum unload unstable controller. Change controller and shorten timeout from 600 to 5 sec, FS/W CCR399. Gyro scale factor larger than .1% will prevent Kalman filter from working in observing mode.
2a	6/19/00	Complete	1465/ 5 Closed	Flatsat / MITOC		Maneuver	
2b	6/21/00	Complete	1466/ 11 Closed	Flatsat / MITOC		P1 Maneuver - Aborted due to FDC trip; Contingency Replan of P2, FDC 39/TSM 23 DV Perf aborted burn	Capture contingency procedure to safe spacecraft and then restart the burn
2c	7/6/00	Complete	1499/ 9 Closed	Flatsat / MITOC		P2 Maneuver - Recovery from aborted P1; Exercised Replanning	Kalman Filter stopped updating after maneuver
2d	08/29/00	Complete - Need to work Attitude Reference w/o AST in radiation belts	1614/ 8 closed	Flatsat / MITOC		PFinal Maneuver - Continued recovery from aborted P1 (sim 2b),	PR 3 Kalman Filter Updates Stopped. PFR 326 Quatgen generates CQT outside DSS FOV, PFR 327 Need ability to set attitude estimate without Tracker in Radiation belts. Need to capture the gyro failure contingency procedure.



Mission Simulations

Mission Simulations

Mission Sim	Date	Status	WOA / PRs Open	Platform	Script Lead / Contingency Lead	Scope	Results
3	10/27/00	Complete - Need to Redo to checkout HRSN Failure, see 3' Sim	1709/ Open	S/C / SMOC		Launch to Acquisition	Some CM issues with SMOC database and loaded TSMs, Separation time, Battery temp limit hit, adjusted Launch limit to 19.5C, Procedure related confi problems found inside L-15, ran out of launch window, Scrub
3a	11/01/00	Complete	1718/ Open	Flatsat / SMOC		Launch --> Sep --> Dep --> Acq	
3b	11/02/00	Complete	1718/ Open	Flatsat / SMOC		1) Safehold Checkout, 2) Cal Burns	
2e	01/10/01	Complete	1800/ Open	Flatsat / SMOC	S. Andrews	PFinal Maneuver - Correction	Procedureproblem with downlink of maneuver results, did not dump flight recorder memory
5	01/01/01	Complete		(TV Pumpdown), S/C / SMOC, CTT / RFSOC		Launch --> Dep --> Acq	Procedure Problems. Inside L-20 was slow due to tlm timeouts, Timing for RTS and PSE was questionable. Need to do over.
5a1	Feb 8-9, 2001	Complete	1819/ 5 Closed	TV Transition, S/C / SMOC		Normal Ops	Recovered via XRSNB and then reset XRSNA. Worked commanding issues with retransmit and COP 1
5a2	02/17/01 Thermal Vac	Complete	1820/ 8	Thermal Balance, S/C / MITOC		ETE RF Compatibility w/ CTT & TDRS	FEDS commanding s/b NRZL, DSN not to work in burst mode PFR 362, ATS load is byte swapped yet again, Large retransmit command get clobbered by CI PFR 363, modify power pages to identify S/A failures, PR8 End to end timing issue with DSN CTT year field, di



Mission Simulations

Mission Sim	Date	Status	WOA / PRs Open	Platform	Script Lead / Contingency Lead	Scope	Results
5a2.1	03/10/01	Complete	1857/ 9	S/C / SMOC, CTT / RFSOC		Normal Ops	Worked Linux Workstation issues and STOL proc issues
5b1	03/04/01 Thermal Balance			(TV Pumpdown), S/C / MITOC		Launch --> Dep --> Acq	
5b2	03/06/01 Thermal Balance			Thermal Balance, S/C / MITOC		ETE RF Compatibility w/ CTT & TDRS	
5b3	03/10/01 Thermal Balance			Thermal Balance,S/C / SMOC		Normal Ops	
2e	03/15/01	Complete		Flatsat	S. Andrews	PFinal Maneuver - Correction	P final maneuver ok, Delayed start due to problems linking correct Gyro bias for redundant Gyro. Intential Hacker corrupted Operational Procedure
3'	3/23/2001 Post T/V	Complete		S/C	S. Glockner & B. Twambly	Redo Launch to Acquisition thru Instrument On, using expected Battery Profile.	Countdown proceeded well. GSE configuration problem curtailed sim after launch. Need to do over
	03/24/01	Complete		S/C	E.J. Bickley	Contingency Procedure Checkout	

Mission Simulations

Mission Sim	Date	Status	WOA / PRs Open	Platform	Script Lead / Contingency Lead	Scope	Results
4a	03/29/01	Complete		Flatsat	S. Andrews	P1 Maneuver	No Script available, CM questions with maneuver data, Ground System Redundancy not available, Perigee Maneuver Proc could not be restarted, TSM Proc runs too slow at 2K, Burn Executed Nominally
6	4/8/2001, Pre-Ship	Complete	1899	S/C	S. Glockner	Launch and Acq. Repeat Mission Sim 3' from 3/23/01	Successfully Recovered from Failed MV and HRSN. Discovered Safehold will drive S/C to sun with Arrays Stowed. Power survuved with Failed PWM. Launch Proc needs specific PSE Wheel timer commanded.
4b	04/13/01	Complete	1913, No Prs Written	Flatsat	S. Andrews	PFinal Maneuver - ACS Contingency	Preps ATS byte swapped, again; time not correlated between workstations; delta V proc executes slow, TSM/RTS slow, PSE tlm failure hows EVD power should always remain on. UPS tripped off due to faulty power strip 5 minutes prior to burn. Warning for the S
6a	April 17&18, 2001	Complete		Flatsat	B. Twambly	Maneuver Proficiency & Contingency. Sim Maneuver Process(Traj, Hi Fi, Flatsat Ver, Flatsat Sim) in Real Time.	Reran the Pf maneuver wit a failed thruster. Found that partial table load proc overwites MV memory if the current value table is not up to date. Table load needs to be fixed. Found that Flatsat, S/C and Navgse are not using a consistent S/C Mass.
5c	April 19&20, 2001			Flatsat	S. Glockner & B. Twambly	1) Separation, IOC & Cal Burns, 2) Maneuver	
	05/02/01	Complete		S/C	J. McCabe & M. Bay	Contingency Procedure Checkout	

Mission Simulations

Mission Simulations

Mission Sim	Date	Status	WOA / PRs Open	Platform	Script Lead / Contingency Lead	Scope	Results
7	05/04/01, Post-Ship	Complete	1934/23 Open	S/C	S. Glockner & B. Twambly	Launch, Check end-toend via Mil-71, TDRS & DSN --> Deploy & Contingency,	Many problems with voice loops and protocol for using loops. Ran into table dump problem again. Time not synced across workatations yet again. Need a working countdown clock. Numerous procedure mods. Need to resolve how to manage and keep the flight table
2f	05/05/01	Complete	1937/	Flatsat	S. Andrews	Mid-Course Correction	Set up automated burn with built in stop rts. Ground disable the stop RTS 181. Move filter tbale changes before spin down. Modify Stored Cmd generation to print with actual GMT times. Modify the procedure to add a commented abort burn RTS12 command to all
	05/07/01	Complete	1939/	S/C	D. Ward	Maneuver with Spacecraft (2 to 5 sec). Place S/C into mission mode, simulate the sequence leading up to the maneuver especially the power subsystem and Solar Array.	
7a	May 8&9, 2001			Flatsat	S. Glockner & B. Twambly	Paper SImulation Apogee to P1 Maneuver, P1 to L2	
8a	May 14&15, 2001			Flatsat	B. Twambly	Sep and Acquisition, Launch to Apogee Maneuver Proficiency & Contingency	
8a	05/16/01			Flatsat	B. Twambly	Apogee Maneuver	

Mission Simulations

Mission Sim	Date	Status	WOA / PRs Open	Platform	Script Lead / Contingency Lead	Scope	Results
	05/19/01, Deploy			S/C	S. Glockner	Launch, Verify Umbilical Demate at simulated liftoff,	
8	05/23/01, Pre-Stacking TDRS & Mila			S/C	S. Glockner	Launch, End To End through MILA	
	06/04/01			Flatsat	S. Glockner & B. Twambly	Launch & Contingency, Maneuver w/ failed RWA	
	06/08/01			S/C	S. Glockner & B. Twambly	Normal Ops through MIL-71, Practice Loss of Comm Paths	
	06/09/01			S/C	S. Glockner & B. Twambly	Normal Ops through MIL-71, Practice Loss of Comm Paths	
	06/11/01			Flatsat	S. Glockner & B. Twambly	Launch & Contingency, Maneuver	
	06/12/01			S/C	S. Glockner & B. Twambly	Launch Scrub and Battery Recharge	
	06/18/01			Flatsat	S. Glockner & B. Twambly	Launch & Contingency, Maneuver	
	Add this in June				S. Glockner & B. Twambly	L2 Momentum Unload, Work Procedure to stop spin and precess Z axis to burn attitude without violating 20 to 25 deg cone	
	06/22/01, T-6			S/C	S. Glockner & B. Twambly	Demonstration: Launch & Contingency, Table Dumps for MV Tables	
	06/28/01					Rehearsal (Paper & Voice)	

SMOC Configuration Control

- CM System considerations
  - Simple end-user input mechanism
  - Revision control to allow for rollback to previous versions
  - Unambiguous and reliable distribution
- Operational considerations
  - I&T procedures not appropriate to on-orbit operations
  - Continuing I&T work at the Cape
  - Possible need to command S/C from SMOC but with I&T products
- Ground System Variations
  - Two operating systems: AIX and Linux
    - Different revisions of embedded COTS display system (Sammi)
    - Subtle ASIST behavior differences, e.g. STOL syntax tolerance
  - Prime and backup workstations must be reliably redundant

Ground System Considerations

- Three ASIST products that require tracking and distribution
  - STOL procedures
  - Record Definition Language (RDL) file specifying command, telemetry and ground system data packets
  - Display page definitions
- ASIST system allows for products to appear in more than one location within the directory structure
  - “configured” tree read-only to end-users
  - “global” read-write to end-users
  - However, the global directory will mask the configured directory
- The CM system must ensure that untracked products are not executed unless specifically required and authorized

CM System Flow

- End-user responsibilities
  - The end-user will transfer a soft copy to a special account on the buddys machine in the SMOC (the “inbox”)
  - The end-user acquires authorization for the product through hardcopy and signatures and deposits these in the SMOC. Alternatively for those at the Cape, an email attesting to the signatures will be sufficient. The hardcopy should be delivered when possible
- Once these steps are complete, the CM system is responsible for ingesting, scanning, tracking and distributing the products to the SMOC systems

CM System Flow

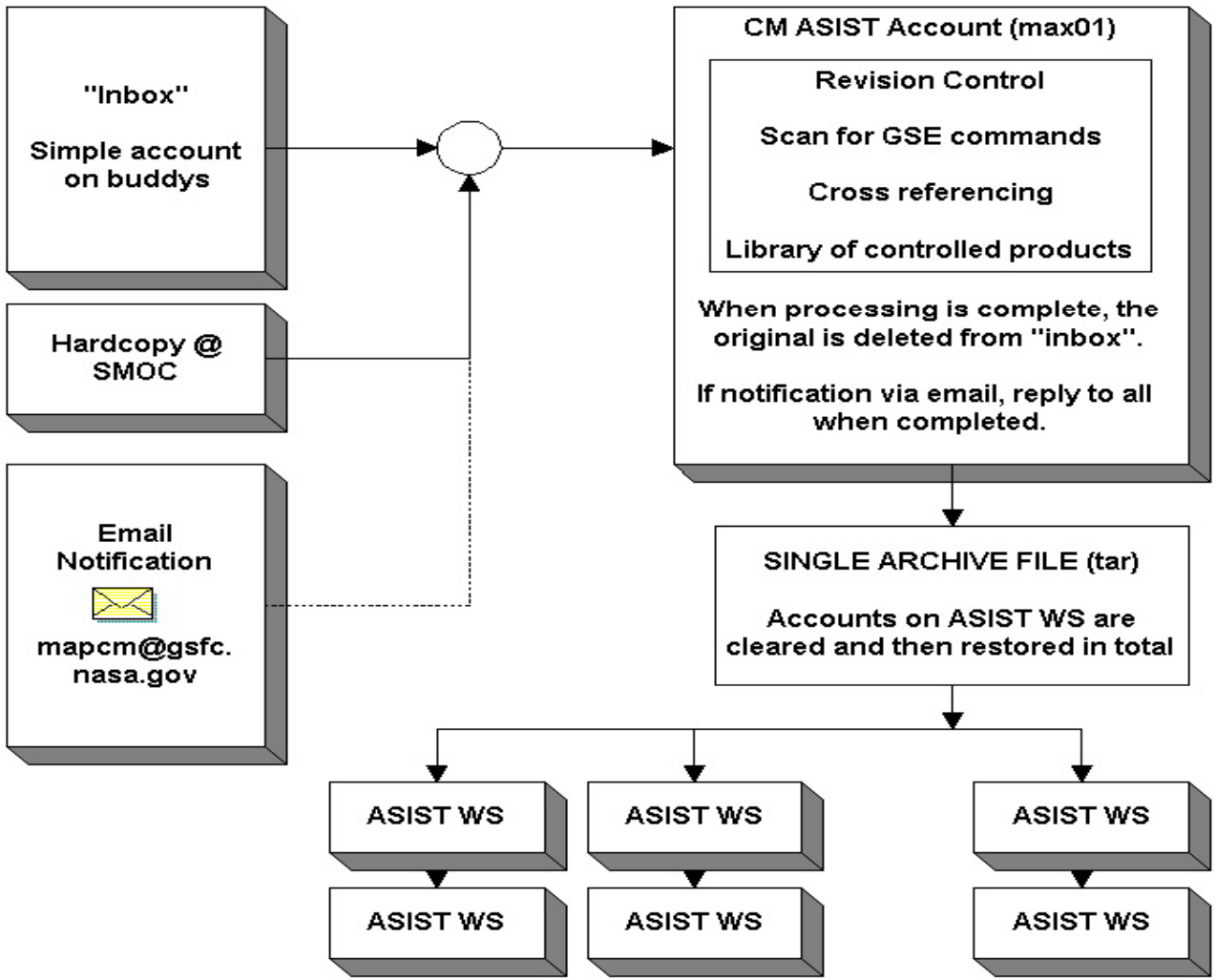
SMOC Configuration Control

1) End-user deposits soft-copies of updates on FTP server.

2a) End-user drops off signed CM form at SMOC. Processing begins.

- or -

2b) End-user emails CM and Authorizer of new product attesting that the updated product has the correct signatures.



CM System Flow

- When CM personnel receives signature notification…
  - Files are transferred to max01 under the asistcm account
  - Procs are compiled and scanned for GSE commands, “m2” references, differences from last version, etc.
  - If OK, the file is revision controlled with RCS
  - Display pages are converted to their ASCII equivalent source and the equivalent Linux page generated
  - After submission, the input file on buddys is moved to either the imported or notimported subdirectory
- All additions and updates to procedures and rdl are tracked in an Excel spreadsheet called “THELIST” and is periodically circulated for review.

CM System Flow

- For review and distribution, three tar archive files are created via a batch process:
  - A small archive containing only procs, rdl and reports for external circulation and review.
  - A larger archive containing the above and the ASCII equivalent to the display pages. This archive represents the source files.
  - The largest archive, containing the above plus the compiled display pages for both AIX and Linux platforms. This archive represents the executable files.
- SMOC distribution for each platform (AIX and Linux)
  - Delete procs and rdl from both the “configured” and “global” areas
  - Extract the controlled products from the large “executable” archive

Operational Considerations

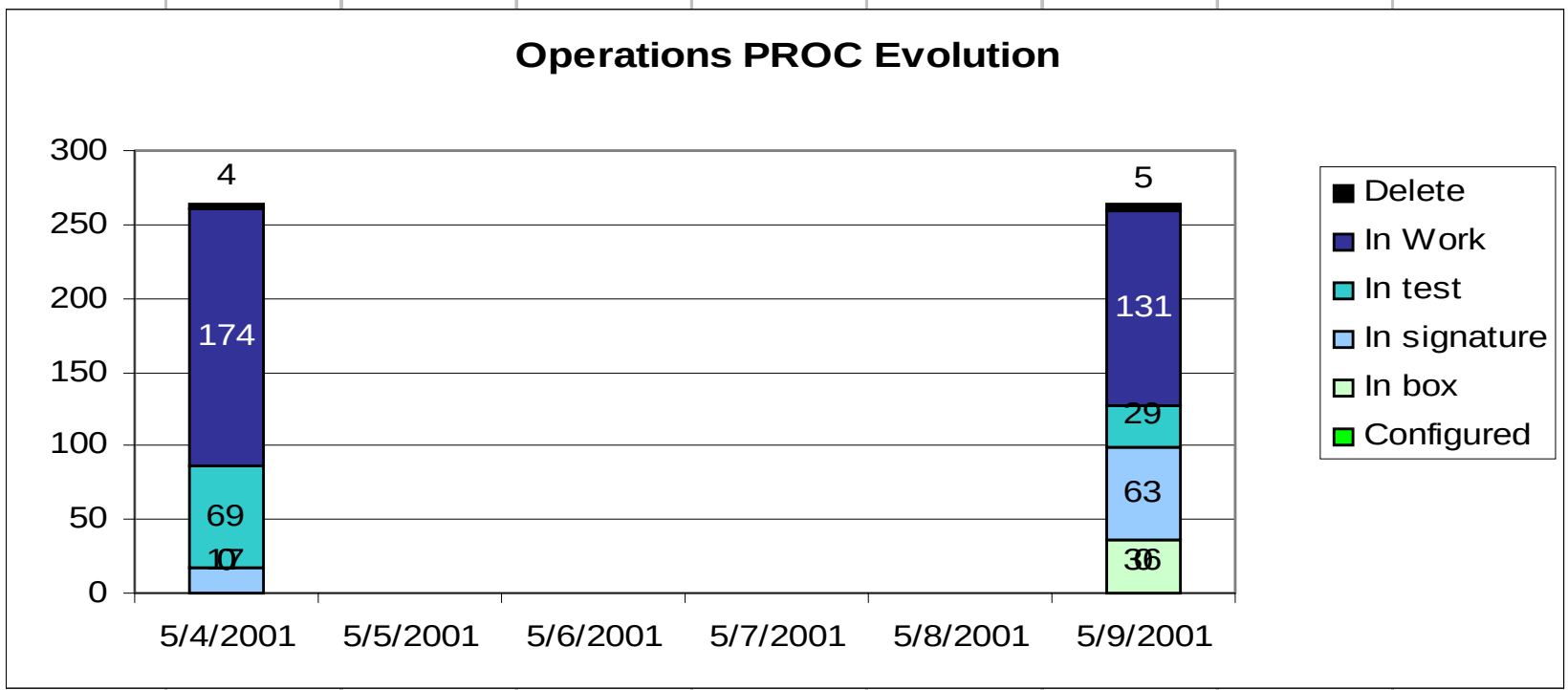
- The SMOC products will be distributed on a schedule.
- Since KSC maintains I&T related products, for special pre-launch events, a tar archive from the Cape system can be transferred to the SMOC and the content temporarily extracted to the “global” areas.

Status

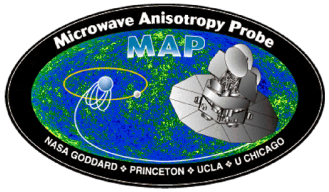
- Display pages and rdl files have been transferred directly into the operations database
- CM system will accept new page definitions as necessary and available
- RDL maintained as a complete set between KSC and GSFC. Likely changes will be few and flow from KSC to the SMOC
- STOL procedures required for operations have been identified from several sources:
  - IOC / Maneuver specific
  - General use, tool chest (e.g. routine ops, periodic ops)
  - Contingency

STOL Procedure Development

Procedure Development



Expected	263							Status Errors
Status	0	36	63	29	130	5	263	0
Date	Configured	In box	In signature	In test	In Work	Delete	Total	
4-May-01	0	0	17	69	174	4	264	
9-May-01	0	36	63	29	131	5	264	



STOL Procedure Tracking

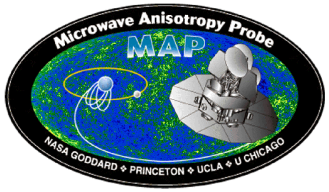
Procedure Development

I&T Information								ersion S	OPS CM Status				
Last Revised: 7 May						SOURCE OPS Type				Status			
This list was compiled from the sources input on the remaining three						R = Routine	S = Special	Status:		Grandfathered			
rolled up.						P = Periodic	C = Contingency			Submitted			
								In work		Accepted			
	SOURCE						G = Ground S	In Signature		Rejected			
I&T Proc Name	Ops Type	IOC	Maneuver	Subsys	Priority	Rev	Date	Owner	In test; In box; Configure	Ops Proc Name	Status	CM Date	Ops Rev	Ops Proc Rev Date
ace_go_no_go.prc				A	1	?	16-Jan-01	CDH	In work					
cdh_go_no_go.prc				A	1	?	10-Jan-01	CDH	In work					
cfgmon_dir.prc	G				1	A	29-Feb-01	George	In box	cfgmon_dir	Grandfathered	24-Apr-01		
cfgmon_runner.prc	G				1	A	29-Feb-01	George	In box					
check_cqt.prc				A	3	?		ACS	In work					
cmdgateway_dir.prc	G			A	1	C	29-Jan-01	George	In work	cmdgateway_dir	Grandfathered	24-Apr-01		
dirtwostep.prc	G			A	1	A	11-Jul-00	Kevin B	In work	dirtwostep	Grandfathered	24-Apr-01		
down_dir.prc	G			A	1	A	11-Jul-00	Kevin B	In work	down_dir	Grandfathered	24-Apr-01		
dsn_dest_dir.prc	G			A	1	B	20-Aug-99	George	In work	dsn_dest_dir	Grandfathered	24-Apr-01		
fedstlm_dir.prc	G			A	1	B	1-Feb-01	George	In work	fedstlm_dir	Grandfathered	24-Apr-01		
fire_both_hkrsn.prc				A	2	?	23-Mar-01	CDH	In work					
fire_pri_mac_ace.prc				A	2	?	23-Mar-01	CDH	In work					
fire_red_lmac_ace.prc				A	2	?	23-Mar-01	CDH	In work					
fsw_launch_verify.prc				A	1	2	8-Apr-01	FSW	In work					
fsw_limits.prc	G			A	1	H	8-Apr-01	FSW	In work					
gsecmd_dir.prc				A	1	B	29-Jan-01	Kevin B	In work	gsecmd_dir	Grandfathered	24-Apr-01		
inform_dir.prc	G			A	2	A	11-Jul-00	Kevin B	In work	inform_dir	Grandfathered	24-Apr-01		
load_dump_def.prc	G			A	1	B	6-Mar-00	Judy P	In work	load_dump_def	Grandfathered	24-Apr-01		
log_pr_dir.prc	G				1	A	11-Jul-00	Kevin B	In work	log_pr_dir	Grandfathered	24-Apr-01		
m2acs_kf_pre_cal.prc				A	1	?		Judy P	In work					
m2balvpcserv.prc	S	I			1	I	17-Feb-01	Judy P	In signature					
m2ca_ace_cold_recovery.prc	C			A	3	B	19-Apr-01	Judy P	In signature					
m2ca_ast_setbrightness.prc	C	I		A	1	A	13-Apr-01	Judy P	In signature					
m2ca_ast_setfocallength.prc	C	I		A	1	A	13-Apr-01	Judy P	In signature					

STOL Procedure Tracking, Con't

Procedure Development

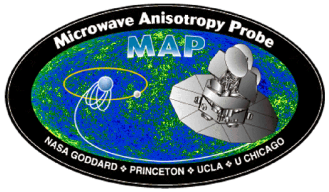
m2ca_css_dynamic_fault.prc	C			A	2	D	19-Apr-01	Judy P	In signature							
m2ca_css_static_fault.prc	C			A	2	D	19-Apr-01	Judy P	In box							
m2ca_isovalve_test.prc	C			A	2	A	19-Apr-01	Judy P	In box							
m2ca_macs_thruster_reconfig.prc	C			A	2	3	18-Apr-01	Judy P	In signature							
m2ca_resume_burn.prc	C			A	2	D	19-Apr-01	Judy P	In signature							
m2ca_shakearray_rw a.prc	C			A	2	C	19-Apr-01	Judy P	In signature							
m2ca_shakearray_thruster.prc	C			A	2	B	19-Apr-01	Judy P	In signature							
m2ca_thruster_seat.prc	C			A	2	A	19-Apr-01	Judy P	In signature							
m2ca_thruster_test.prc	C			A	2	B	19-Apr-01	Judy P	In signature							
m2cacedeltah.prc	C			A	2	G	19-Apr-01	Judy P	In signature							
m2cacerw atqlimit.prc	C			A	2	A	18-Apr-01	Judy P	In box							
m2calmacacepw r	C	I		A	1	O	30-Jan-00	Judy P	In w ork							
m2camacsdeltah.prc	C			A	2	C	19-Apr-01	Judy P	In signature							
m2capropcfg.prc	C			A	2	B	18-Apr-01	Judy P	In box							
m2capropcfgoff.prc	C			A	2	C	19-Apr-01	Judy P	In box							
m2carw aoffnow .prc	C			A	2	B	19-Apr-01	Judy P	In box							
m2carw aonnow .prc	C			A	2	C	19-Apr-01	Judy P	In box							
m2caupdquat.prc	C			A	3	B	9-Apr-01	Judy P	In box							
m2caupdquatw cmd.prc				A	3	A	9-Apr-01	Judy P	In signature							
m2cdampiv	C			D	1	A	27-Apr-01	Lacombe	In test							
m2cdcoldrst	C			D	1	A	2-Apr-01	Lacombe	In test							
m2cdeepromarray	C			D	1	A	29-Apr-01	Lacombe	In test							
m2cdeepromcmlist	C			D	1	A	21-Mar-01	Lacombe	In test							
m2cdhemtonoff	C			D	1	A	19-Feb-01	Lacombe	In test							
m2cdhkpatch	C			D	1	A	27-Apr-01	Lacombe	In test							
m2cdinstoff	C			D	1	A	21-Mar-01	Lacombe	In test							
m2cdldeepromcmdablegate	C			D	1	A	5-Apr-01	Lacombe	In test							
m2cdldeepromfixedgate	C			D	1	A	5-Apr-01	Lacombe	In test							
m2cdloadcmeeprom	C			D	1	A	29-Apr-01	Lacombe	In test							
m2cdradiv	C			D	1	A	27-Apr-01	Lacombe	In test							
m2cdrebiascmdablegate	C			D	1	A	5-Apr-01	Lacombe	In test							
m2cdrebiasfixedgate	C			D	1	A	5-Apr-01	Lacombe	In test							
m2cdrstbiasvolt	C			D	1	A	19-Feb-01	Lacombe	In test							



STOL Procedure Tracking, Con't

Procedure Development

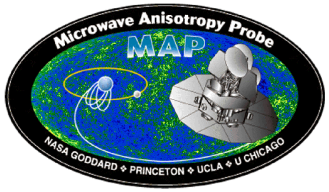
m2cdsftwarerst	C			D	1	A	2-Apr-01	Lacombe	In test							
m2cdwarmrst	C			D	1	A	2-Apr-01	Lacombe	In test							
m2chstopdeploy	C				2	C	10-Feb-00	Judy P	In signature							
m2cminit	C				1	AF	5-Apr-00	Judy P	In work							
m2cmrtsstop	C				2	B	3-Aug-00	Judy P	In box							
m2cmtcjamclocknow	C			A	1	F	2-Aug-00	Pete G	In work							
m2cmvcold	C				2	F	24-Jul-00	Judy P	In signature							
m2cmvpromboot	C				3	E	21-Jul-00	Judy P	In signature							
m2cmvswitch	C				3	N	5-Apr-00	Judy P	In signature							
m2cmvwarm	C				2	F	17-Feb-00	Judy P	In signature							
m2cpinit	C				1	K	2-Apr-00	Nick G	In test							
~~m2cpostsc7lims~~	~~I&T~~	~~I&T~~	~~I&T~~		~~3~~	~~A~~	~~17-Feb-00~~	~~Nick G~~	~~Delete~~							
~~m2cppwroff~~	~~I&T~~	~~I&T~~	~~I&T~~		~~3~~	~~?~~	~~8-Apr-00~~	~~Nick G~~	~~Delete~~							
~~m2cprsnov~~	~~I&T~~	~~I&T~~	~~I&T~~		~~2~~	~~D~~	~~28-Jul-00~~	~~Nick G~~	~~Delete~~							
m2cprtrst	C				3	A	24-Jul-00	Nick G	In signature							
m2cpsamrst	C				3	A	24-Jul-00	Nick G	In signature							
m2cpsasegmsk	C				3	D	24-Jul-00	Nick G	In signature							
~~m2cpsasegver~~	~~I&T~~	~~I&T~~	~~I&T~~		~~3~~	~~C~~	~~24-Jul-00~~	~~Nick G~~	~~In test~~							
m2cpscmd1	C				3	H	24-Jan-00	Nick G	In signature							
m2cpscmd7	C				3	G	30-Jan-00	Nick G	In signature							
m2cspecialcmd	G				1	D	24-Jan-00	Judy P	In work	cspecialcmd	Grandfathered	24-Apr-01				
m2cxbroadside	C			A	1	B	8-Apr-00	Pete G	In work							
m2cxdlreset	C				2	B	21-Jul-00	Pete G	In work							
m2cxmtrpwr	C				2	F	24-Jan-00	Pete G	In work							
m2cxmtrpwrspcmd	C				2	H	24-Jan-00	Pete G	In work							
m2cxrsnbomni	C				3	C	8-Apr-00	Pete G	In work							
m2cxrsnrst	C					F	24-Jan-00	Pete G	In work							
m2dsnacq.prc		I	M		1	?		George	In box							
m2dsntodsn.prc		I			1	?		George	In box							
m2facs_ace_limits_launch.prc		I		A	1	A	14-Apr-01	ACS	In work							
m2facs_ace_limits_nominal.prc		I		A	1	A	14-Apr-01	ACS	In work							
m2facs_ace_limits_perigee.prc		I		A	1	A	14-Apr-01	ACS	In work							



STOL Procedure Tracking, Con't

Procedure Development

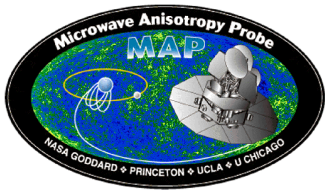
m2facs_ace_limits_separation.prc		I		A	1	A	14-Apr-01	ACS	In work							
m2facs_acs_limits_alive.prc		I		A	1	?	7-Dec-00	ACS	In work							
m2facs_acs_limits_launch.prc		I		A	1	A	14-Apr-01	ACS	In work							
m2facs_acs_limits_nominal.prc		I		A	1	A	14-Apr-01	ACS	In work							
m2facs_acs_limits_perigee.prc		I		A	1	A	14-Apr-01	ACS	In work							
m2facs_acs_limits_separation.prc		I		A	1	A	14-Apr-01	ACS	In work							
m2facs_acsconfig.prc		I		A	1	S	16-Feb-01	Judy P	In work							
m2facs_altacecmd.prc				A	3	C	2-Feb-01	FSW	In work							
m2facs_ast_limits_launch.prc		I		A	1	A	14-Apr-01	ACS	In work							
m2facs_ast_limits_nominal.prc		I		A	1	A	14-Apr-01	ACS	In work							
m2facs_ast_limits_perigee.prc		I		A	1	A	14-Apr-01	ACS	In work							
m2facs_ast_limits_separation.prc		I		A	1	A	14-Apr-01	ACS	In work							
m2facs_astsetfailedacqslimit.prc				A		1	13-Jan-00	ACS	In work							
m2facs_limits_launch.prc				A	1	A	14-Apr-01	ACS	In work							
m2facs_limits_nominal.prc				A	1	A	14-Apr-01	ACS	In work							
m2facs_limits_perigee.prc				A	1	A	14-Apr-01	ACS	In work							
m2facs_limits_separation.prc				A	1	A	14-Apr-01	ACS	In work							
m2ggalive	R				1	K	1-Sep-00	Kevin B	In work							
m2ggaws	R				1	F	15-Oct-99	Kevin B	In work							
m2ggbitsyncfg.prc		I			1	F	28-Jun-00	Kevin B	In work							
m2ggfedscfg	R				1	U	13-Feb-01	Kevin B	In work							
m2ggfedscfg.prc		I			1	U	13-Feb-01	Kevin B	In work							
m2ggfedscheck	R				1	C	21-Aug-00	Kevin B	In work							
m2ggfedspwr	R				1	K	27-Jun-00	Kevin B	In work							
m2md_dwelltables.prc		I			1	?		FSW	In work							
m2pdcolddnilimits	P			D	1	A	21-Mar-01	Lacombe	In test							
m2pdcoldlimdef	P			D	1	C	10-Apr-01	Lacombe	In test							
m2pddnipseudolimoff	P			D	1	A	21-Mar-01	Lacombe	In test							
m2pddnipseudolimon	P			D	1	A	21-Mar-01	Lacombe	In test							
m2pdfpadrainlimoff	P			D	1	A	3-Apr-01	Lacombe	In test							
m2pdfpadrainlimon	P			D	1	A	3-Apr-01	Lacombe	In test							
m2pdinstlimoff	P			D	1	A	21-Mar-01	Lacombe	In test							
m2pdinstlimon	P			D	1	A	21-Mar-01	Lacombe	In test							



STOL Procedure Tracking, Con't

Procedure Development

m2pdinstoverlay	P			D	1	C	10-Apr-01	Lacombe	In test							
m2pdwarmdnilimits	P			D	1	A	21-Mar-01	Lacombe	In test							
m2pmephemupdate	R	I	M	A	1	B	3-Aug-00	Dale F	In work							
m2ra_startup	R			A	3	M	30-Jan-00	ACS	In work							
m2rc_startup	R				3	Y	24-Jan-00	CDH	In work							
m2rccmd_startup	R				1	M	21-Jul-00	Kevin B	In work							
m2re_startup	R				3	B	24-Jul-00	Kevin B	In work							
m2rgpws_startup	R				3	O	8-Dec-00	Kevin B	In work							
m2rmdscloseds	R	I	M		1	AB	24-Jul-00	Judy P	In box							
m2rmdsevtnorm	R	I	M	A	1	J	28-Jul-00	Judy P	In box							
m2rmdsoverwrite	R	I		A	1	B	28-Jul-00	Judy P	In box							
m2rmdspbabort	R	I		A	1	J	28-Jul-00	Judy P	In box							
m2rmdspbcont	R	I			1	M	11-Feb-00	Judy P	In box							
m2rmdspbnorm	R	I	M	A	1	L	11-Feb-00	Judy P	In box							
m2rmdsrelds	R	I	M	A	1	J	28-Jul-00	Judy P	In signature							
m2rmdsrxmds	R	I			1	I	11-Feb-00	Judy P	In signature							
m2rp_startup	R			A	3	AB	23-Jan-00	Nick G	In work							
m2sa_inertial_ioc_cfg		I		A	1	?		ACS	In work							
m2sa_kalman_ioc_cfg		I		A	1	?		ACS	In work							
m2sa_observing_ioc_cfg		I		A	1	?		ACS	In work							
m2sa_reset_slew		I		A	1	?		ACS	In work							
m2sa_scanrate		I		A	1	?		ACS	In work							
m2sa_slow_slew		I		A	1	?		ACS	In work							
m2sa_upd_drift_bias		I		A	1	?		ACS	In work							
m2sa_upd_scalefactors		I		A	1	?		ACS	In work							
m2sacatbedcfg.prc				A	2	B	6-Nov-00	ACS	In signature							
m2sacqtcfg.prc		I	M	A	1	?		Judy P	In signature							
m2saevdcfg.prc				A	3	B	6-Nov-00	Judy P	In signature							
m2saexitsh.prc		I		A	1	?		Judy P	In signature							
m2safixabsrelchecks	R	I		A	1	C	10-Feb-00	Judy P	In signature							
m2sagodeltah.prc				A	1	D	7-Jun-00	Judy P	In signature							
~~m2sagodeltav.prc~~				~~A~~	~~3~~	~~A~~	~~19-Mar-01~~	~~Judy P~~	~~Delete~~							
m2sagoinertial.prc		I		A	1	C	28-Nov-00	Judy P	In work							



STOL Procedure Tracking, Con't

Procedure Development

m2sagoobserving.prc		I	M	A	1	A	9-Jun-00	Judy P	In work							
m2sagosh.prc		I		A	1	C	6-Nov-00	Judy P	In signature							
m2sagosunacq.prc		I		A	1	B	27-Nov-00	Judy P	In signature							
m2saisovalvepwr.prc				A	3	A	1-Nov-00	Judy P	In signature							
m2sapropcfg.prc		I		A	1	?		Judy P	In signature							
m2sastloadcalops	R	I		A	1	B	24-Jul-00	Judy P	In signature							
m2sastuinfo	R	I		A	1	B	24-Jul-00	Judy P	In signature							
m2sathrustercfg.prc				A	1	B	6-Nov-00	Judy P	In signature							
m2sdinston		I		D	1	B	29-Apr-01	Lacombe	In test							
m2shhtrdump	R	I			1	B	13-Feb-00	Judy P	In signature							
m2shlvpcserv	R	I			1	J	10-Feb-00	Judy P	In box							
m2shrfrly	R	I			1	H	10-Feb-00	Judy P	In box							
m2smdsfltrtbl	R	I	M	A	1	A	21-Jul-00	Judy P	In box							
m2smdsjam	R				1	B	3-Aug-00	Judy P	In box	smdsjam	Accepted	30-Apr-01	A	#######	Calls smsystemtableload	
m2smloaddefaulttable	R	I			1	C	10-Feb-00	Judy P	In box							
m2smmemdwellcfg	R	I		A	1	B	24-Jul-00	Judy P	In box							
m2smmtldump	R				1	I	25-Jul-00	Judy P	In signature							
m2smrtsstart	R				1	B	3-Aug-00	Judy P	In signature							
m2smscatsswitch	R	I			1	A	24-Jul-00	Judy P	In box	smscatsswitch	Accepted	30-Apr-01	A	#######		
m2smscrtscfg	R			A	1	A	24-Jul-00	Judy P	In signature							
m2smsystemtabledump	R	I	M	A	1	B	10-Feb-00	Judy P	In signature							
m2smsystemtableload	R	I	M	A	1	E	3-Aug-00	Judy P	In box							
m2smtcadjutcf	R			A	1	B	21-Jul-00	Pete G	In signature							
m2smtcjamleaputcf	R			A	1	B	21-Jul-00	Pete G	In work							
m2smtcjamutcf	R			A	1	B	21-Jul-00	Pete G	In work							
m2smtofltrtbl	R	I	M	A	1	A	24-Jul-00	Judy P	In box							
m2smtojam	R			A	1	C	24-Jul-00	Judy P	In box	smtojam	Accepted	30-Apr-01	A	#######		
m2smtsminspect	R	I	M	A	1	I	3-Aug-00	Judy P	In box							
m2smvclearrst	R			A	1	C	21-Jul-00	Judy P	In work							
m2smxbbussel	R			A	2	B	24-Jul-00	Judy P	In box							
m2snoop	R	I		A	1	E	24-Jul-00	Judy P	In box	snoop	Accepted	30-Apr-01	A	#######		
m2soacqcleanup.prc		I			1	?		Judy P	In work							
m2solaunch_gsfc.prc		I		A	1	Y	23-Apr-01	Judy P	In work							

STOL Procedure Tracking, Con't

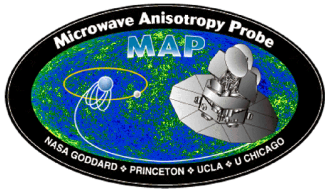
Procedure Development

m2spcrst	R				2	B	24-Jul-00	Nick G	In signature							
m2spflushem	R			A	1	B	5-Apr-00	Nick G	In signature							
m2splvpc	R	I			1	L	5-Apr-00	Nick G	In signature							
m2splvpc3to5	R	I			1	A	5-Apr-00	Nick G	In signature							
m2splvpctrp	R				2	D	24-Jul-00	Nick G	In signature							
m2spsecd	R				2	D	24-Jul-00	Nick G	In signature							
m2spsedesi	R	I			1	J	24-Jul-00	Nick G	In signature							
m2spsetrki	R	I			1	F	5-Apr-00	Nick G	In signature							
m2spsevt	R	I			1	S	5-Apr-00	Nick G	In signature							
m2spsocinit	R	I			1	D	16-Aug-00	Nick G	In signature							
m2spsspc	R	I		A	1	O	24-Jul-00	Nick G	In signature							
~~m2spssver~~	R				~~2~~	~~D~~	~~5-Apr-00~~	~~Nick G~~	~~Delete~~							
m2spwrst	R				2	C	2-Aug-00	Nick G	In signature							
m2srfranging.prc		I	M		1	?		Pete G	In box							
m2srsnclearwarm	R			A	2	D	21-Jul-00	Judy P	In work							
m2srsnloaddump	R				2	G	2-Aug-00	FSW	In work							
m2srsnmemdiag	R			A	3	B	16-Aug-00	FSW	In work							
m2ssfswload	R				1	B	1-Mar-00	FSW	In work							
m2ssmatsload	R	I	M	A	1	G	3-Aug-00	Judy P	In box	ssmatsload	Accepted	30-Apr-01	A	#######		
m2ssmatsstart	R	I	M	A	1	C	24-Jul-00	Judy P	In box	ssmatsstart	Accepted	30-Apr-01	A	#######		
m2ssmrtsload	R			A	1	F	3-Aug-00	Judy P	In signature	smrtsload						
m2stsmoncfg	R			A	1	A	24-Jan-00	Judy P	In signature	stsmoncfg	Accepted	30-Apr-01	A	#######		
m2sxauxosc	R	I			1	A	21-Jul-00	Pete G	In signature							
m2sxstdcfg	R				1	I	24-Jan-00	Pete G	In signature							
m2sxtlmcfg	R				1	F	21-Jul-00	Pete G	In work							
m2sxtlmtest	R				1	D	21-Jul-00	Pete G	In work							
m2sxuldlsel	R				1	I	24-Jan-00	Pete G	In work							
m2tdrsacq.prc		I	M		1	?		George	In signature							
		I	M		1	A		George	In box							
m2tdrstodsn.prc		I	M		1	?		George	In signature							
m2tdrstotdrs.prc		I			1	?		George	In work							
map_startup.prc				A	1	A	13-Jul-00	Kevin B	In work	map_startup	Grandfathered	24-Apr-01				

STOL Procedure Tracking, Con't

Procedure Development

m2spcrst	R				2	B	24-Jul-00	Nick G	In signature							
m2spflushem	R			A	1	B	5-Apr-00	Nick G	In signature							
m2splvpc	R	I			1	L	5-Apr-00	Nick G	In signature							
m2splvpc3to5	R	I			1	A	5-Apr-00	Nick G	In signature							
m2splvpctrp	R				2	D	24-Jul-00	Nick G	In signature							
m2spsecd	R				2	D	24-Jul-00	Nick G	In signature							
m2spsedesi	R	I			1	J	24-Jul-00	Nick G	In signature							
m2spsetrki	R	I			1	F	5-Apr-00	Nick G	In signature							
m2spsevt	R	I			1	S	5-Apr-00	Nick G	In signature							
m2spsocinit	R	I			1	D	16-Aug-00	Nick G	In signature							
m2spsspc	R	I		A	1	O	24-Jul-00	Nick G	In signature							
~~m2spssver~~	~~R~~				~~2~~	~~D~~	~~5-Apr-00~~	~~Nick G~~	~~Delete~~							
m2spw rst	R				2	C	2-Aug-00	Nick G	In signature							
m2srfranging.prc		I	M		1	?		Pete G	In box							
m2srsnclearw arm	R			A	2	D	21-Jul-00	Judy P	In w ork							
m2srsnloaddump	R				2	G	2-Aug-00	FSW	In w ork							
m2srsnmemdiag	R			A	3	B	16-Aug-00	FSW	In w ork							
m2ssfsw load	R				1	B	1-Mar-00	FSW	In w ork							
m2ssmatsload	R	I	M	A	1	G	3-Aug-00	Judy P	In box	ssmatsload	Accepted	30-Apr-01	A	#######		
m2ssmatsstart	R	I	M	A	1	C	24-Jul-00	Judy P	In box	ssmatsstart	Accepted	30-Apr-01	A	#######		
m2ssmrtsload	R			A	1	F	3-Aug-00	Judy P	In signature	smrtsload						
m2stsmoncfg	R			A	1	A	24-Jan-00	Judy P	In signature	stsmoncfg	Accepted	30-Apr-01	A	#######		
m2sxauxosc	R	I			1	A	21-Jul-00	Pete G	In signature							
m2sxstdcfg	R				1	I	24-Jan-00	Pete G	In signature							
m2sxtlmcfg	R				1	F	21-Jul-00	Pete G	In w ork							
m2sxtlmtest	R				1	D	21-Jul-00	Pete G	In w ork							
m2sxuldlsel	R				1	I	24-Jan-00	Pete G	In w ork							
m2tdrsacq.prc		I	M		1	?		George	In signature							
		I	M		1	A		George	In box							
m2tdrstodsn.prc		I	M		1	?		George	In signature							
m2tdrstotdrs.prc		I			1	?		George	In w ork							
map_startup.prc				A	1	A	13-Jul-00	Kevin B	In w ork	map_startup	Grandfathered	24-Apr-01				



STOL Procedure Tracking, Con't

Procedure Development

mopss_dirs.prc					1	B	20-Jul-00	Kevin B	In work	mopss_dir	Grandfathered	24-Apr-01				
pplotbat.prc					3	A	18-Jan-00	PWR	In work	pplotbat	Grandfathered	24-Apr-01				
pplotbus.prc					3	A	18-Jan-00	PWR	In work	pplotbus	Grandfathered	24-Apr-01				
pplotvt.prc					3	A	20-Jan-00	PWR	In work	pplotvt	Grandfathered	24-Apr-01				
pri_deploy_power_off.prc				A	2	?	23-Mar-01	CDH	In work							
pri_deploy_power_on.prc				A	2	?	23-Mar-01	CDH	In work							
pstol_user_startup.prc				A	1	B	11-Mar-99	Kevin B	In work	pstol_user_startup	Grandfathered	24-Apr-01				
pwrtrend.prc					3	A	23-Jan-01	Tim K	In work	pwrtrend	Grandfathered	24-Apr-01				
reset_feds_dir.prc				A	1	B	18-Jan-01	Kevin B	In work							
sa_damper_htr_on.prc				A	1	?	23-Mar-01	CDH	In work							
sadeltavconfig.prc		I	M		1	?		George	In work							
samanualdeltav.prc			M	A	1	A	18-Apr-01	George	In work							
sapostdeltav.prc		I	M		1	?		George	In work							
seqprint_off_acs.prc				A	1	A	12-Sep-00	ACS	In work							
seqprint_off_all.prc	R			A	1	B	31-Jul-00	ACS	In work							
seqprint_on_acs.prc				A	1	A	12-Sep-00	ACS	In work	seqprint_p###	Grandfathered	24-Apr-01				
seqtimed_mac_trend					3	?		?	In work	seqtimed_mac_trend	Grandfathered	24-Apr-01				
Sersmail_dir	R			A	1	B	20-Jul-00	Kevin B	In work	sersmail_dir	Grandfathered	24-Apr-01				
smloadrtsdefaulttable	R	I			1	C	10-Feb-00	Judy P	In work							
switch_lmac_ace_on.prc				A	3	?	23-Mar-01	CDH	In work							
User_directives	R			A	1	C	24-Jul-00	Pete G	In work	user_directives	Grandfathered	24-Apr-01				
User_functions	R			A	1	10	7-Feb-01	Judy P	In work	twrite_func						
User_startup	R			A	1	AG	2-Feb-01	Kevin B	In work	user_startup	Grandfathered	24-Apr-01				
whereis_dir.prc				A	1	A	11-Jul-00	Kevin B	In work	whereis_dir	Grandfathered	24-Apr-01				
zsnap_dir.prc				A	1	A	11-Jul-00	Kevin B	In work	zsnap_dir	Grandfathered	24-Apr-01				
m2fddeu1dighk		L			1	N	29-Apr-01	Lacombe	In work	solaunchfddeu1dighk						
m2fdeepromarray		L			1	D	20-Jul-00	Lacombe	In work	solaunchfdeepromarray						
m2fdeepromcmlist		L			1	M	3-Oct-00	Lacombe	In work	solaunchfdeepromcmlist						
m2fdloadcmeeprom		L			1	I	29-Apr-01	Lacombe	In work	solaunchfdloadcmeeprom						
m2fdpdu2eeprom		L			1	H	3-Oct-01	Lacombe	In work	solaunchfdpdu2eeprom						
m2fdpdu4chonoff		L			1	J	29-Apr-01	Lacombe	In work	solaunchfdpdu4chonoff						
m2finstoff		L			1	C	29-Apr-01	Lacombe	In work	solaunchfinstoff						
m2finstoff_quick		L			1	B	21-Jul-01	Lacombe	In work	solaunchfinstoff_quick						
m2finston		L			1	S	29-Apr-01	Lacombe	In work	solaunchfinston						
m2finston_quick		L			1	G	6-Dec-00	Lacombe	In work	solaunchfinston_quick						
m2gdgdnipseudooff		L			1	B	24-Apr-01	Lacombe	In work	solaunchgdgdnipseudooff						
m2gdgdnipseudoon		L			1	B	24-Apr-01	Lacombe	In work	solaunchgdgdnipseudoon						
m2gdgdrainlimitsoff		L			1	A	5-Jan-00	Lacombe	In work	solaunchgdgdrainlimitsoff						
m2gdgdrainlimitson		L			1	A	5-Jan-00	Lacombe	In work	solaunchgdgdrainlimitson						
m2gdginstlimoff		L			1	L	24-Apr-01	Lacombe	In work	solaunchgdginstlimoff						
m2gdginstlimon		L			1	AE	29-Apr-01	Lacombe	In work	solaunchgdginstlimon						
m2gdginstoverlay		L			1	F	25-Apr-01	Lacombe	In work	solaunchgdginstoverlay						
m2gdgwarmdnilimits		L			1	A	1-Feb-01	Lacombe	In work	solaunchgdgwarmdnilimits						

Contingencies

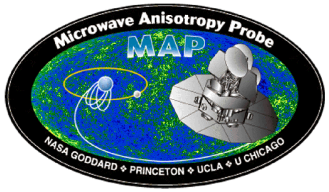
Peter J. Gonzales

Contingencies

- Philosophy
- Testing
- Process
- Flow Chart Development
- Flow Chart Design
- STOL Contingency Procedure Development
- Subsystem Contingency Status Summary
- Detailed List of Subsystem Contingency Status

Contingencies

- Philosophy
  - Develop contingency procedures for mission threatening failures
  - Each contingency should have a flow chart.
  - Consider a single failure
  - Ground involvement and required reaction
  - Augment Onboard Autonomous Action for total Mission Safety

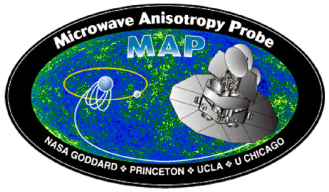


Contingencies

- Contingency testing prior to launch
  - Testing during Mission Simulations and planned contingency test time
    - Testing contingencies means testing both Flow Charts and STOL procedures
  - Test with actual spacecraft within safe operational limitations
  - Test with Flatsat and Hybrid Dynamic Simulator where necessary
  - Some Contingencies are marked as “Pre-Launch Testing Required”

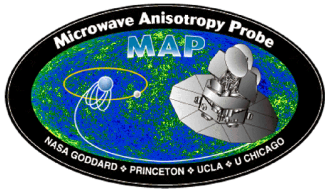
Contingencies Development

- Process
  - Identify Mission Threatening Conditions - Complete
  - Determine if Spacecraft can take some kind of action to mitigate consequence, Separate Onboard versus Ground Actions - Complete
  - Determine if and when the ground can take action - In work
  - Develop Flow Chart - In work
  - Develop Procedure - In Work
  - Test and Verify procedure on Flatsat or S/C - In Work
  - Place under configuration management



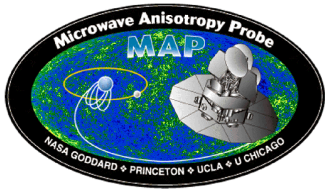
Contingencies Development

- Flow Chart Development
  - Subsystem's are ultimately responsible for contingency flow chart design
    - Subsystems should work with SCT to create STOL procedures which support the contingency
    - Subsystems should work with SCT to understand how flow will run in an ops environment
      - Pass length, commanding constraints, telemetry rates and/or quality
    - Flow charts should be reviewed by systems to consider effects of failures and recoveries on other subsystems



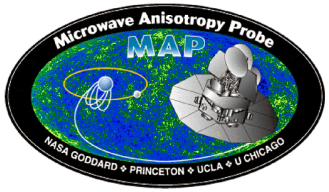
Contingencies Development

- Flow Chart Development (continued)
  - Provide a high level (subsystem/component level) flow chart
    - High level flow charts help map failure symptoms to more detailed contingency charts
  - Try simple, obvious solutions first. Its OK to be redundant.
  - Provide solutions required to “safe the S/C” or condition first
    - locating the source of the problem is not the highest priority (ex. Broadside commanding may mask the source of the problem by recovering numerous possible conditions in one action, but recovery and safing action is more efficient)
    - provide long term solutions if known



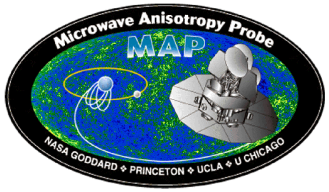
Contingencies Development

- Flow Chart Design
  - Try to be consistent in the design of the flowchart, ie make all No's vertical and all Yes's horizontal (or vice versa)
  - Number all boxes and pages uniquely, this makes the flow easier to follow when many people are involved
  - Include notes on spacecraft constraints and warnings where appropriate in the flow chart
  - STOL Procedures and/or commands associated with particular action boxes should be clearly identified in the procedure
    - Also it is OK to reference an existing text procedure associated with an action box as long as it is attached to the flow chart (ex. If the procedure is too detailed or long to include in the flow itself)



Contingencies Development

- Flow Chart Design (continued)
  - Not all flows need a STOL Proc.
    - It is ok to have commands identified in the flowchart.
  - Be sure to identify the telemetry point mnemonic and crtpage if necessary for any questions in the flow.



Contingencies Development

- STOL Contingency Procedure Development
  - Write simple concise procedures to support actions required
    - Do not write one procedure which handles all branches of the contingency and makes decisions autonomously
      - this allows single function procedures to be run multiple times in any order or combination which may be decided in real time.
  - For procedures where uplk/dnlk quality is questionable, provide a means to send the same command multiple times (send cmds in “bypass” of COP-1)

Contingencies Status

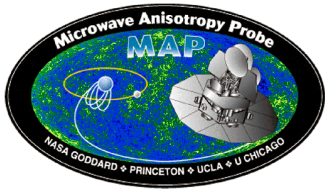
Some Contingency Status Table Parameters

- Criticality
  - 1) S/C test before launch
  - 2) Flatsat test or walkthrough/analysis before launch
  - 3) Walkthrough and review only
  - 4) Network testing before launch
- FMEA/FTA
  - Maps contingencies to systems level Failure Modes and Effects Analysis (FMEA) or Fault Tree Analysis (FTA)
- Flow Chart Status
  - In Work: Flow Chart is in development.
  - Draft Complete: Flow Chart is in the test/review phase. A copy of the flow chart resides in the contingency binder.
  - Complete: Flow Chart has been tested and/or reviewed.

Contingencies Status

Contingency Status Summary

				In Work	Draft Complete	Complete	Total
1	Loss of Comm			3	10	0	13
2	C&DH			1	1	2	4
3	Solar Array Deploy			2	0	1	3
4	ACS			7	15	0	22
5	Maneuver Planning			4	2	0	6
6	Propulsion			0	6	0	6
7	Power			0	7	0	7
8	Instrument			8	0	0	8
9	Thermal			1	0	0	1
10	Launch-Site			7	0	2	9
11	Control Center			2	0	4	6
	Total			35	41	9	85
	Require S/C Test prior to Launch			16	13	4	33
	Require Flatsat Test or Walkthru/Review prior to Launch			6	13	0	19
	Require Network Test prior to launch			2	0	4	6



1. RF Communications

Contingencies

Item	Test Pre Launch	Criticality (1,2,3,4)	Type	ID	FMEA/FTA	Subsystem/ Contingency	Description	Action	Flow Chart Status	STOL Procedures	Test Status
1	**RF - Communications**										
1.1	Yes	1	Identify Anomaly	Loss of Comm (Generic) RF-DNLK-1	FMEA 1.3, 2.1, 2.2, 2.3, 2.4, 2.6	Loss of Dnlk (main)		Command Configuration, Employ Redundancy	Draft Complete		Sim 5a1 (mission), 6 (launch)
1.1.1	Yes	1	Identify Anomaly	RF-DNLK-GND-1		-Ground (assumes DSN)	Assumes RF recvd at site, problem is local or network		Draft Complete	N/A	ETE w/ DSN sites
1.1.2	Yes	1	Identify Anomaly	RF-DNLK-CFG-1		-Ground vs. S/C configuration (assumes DSN)	Mismatch between ground configuration and S/C configuration	Configure GND to match expected S/C, configure S/C to match expected GND	Draft Complete	SXSTDCFG	Proc tested during Mil-71 checkout
1.1.3	Yes	1	Identify Anomaly	RF-DNLK-SC-1		-RF (mission)	Assumes XRSN-B, XPNDR-B, MGA-B	Recover current side or failover redunadant side	Draft Complete	CXBROADSIDE	Sim 5a1
1.1.4	Yes	1	Identify Anomaly	RF-DNLK-SC-2		-RF (L&IOC)	Assumes XRSN-A, XPNDR-A, Omni	Recover current side or failover redunadant side	Draft Complete	CXBROADSIDE, CXRSNBOMNI	Sim 6
1.2	Yes	1	Identify Anomaly	RF-LAUNCH-1 Loss of Comm (First 2 passes)		-No Dnlk (First TDRS and GDS Pass)			Draft Complete		Sims 6 & 7
1.2.1	Yes	1	Identify Anomaly	RF-LAUNCH-GND-1		-Ground (TDRSS or DSN)	Assumes RF recvd at site, problem is local or network		Draft Complete	N/A	Tested PTP failover w/ STGT
1.2.2	Yes	1	Identify Anomaly	RF-LAUNCH-CFG-1		-Ground vs. S/C configuration (TDRSS or DSN)	Mismatch between ground configuration and S/C configuration	Configure GND to match expected S/C, configure S/C to match expected GND	Draft Complete	SXSTDCFG	Proc tested during Mil-71 checkout
1.2.3	Yes	1	Identify Anomaly	RF-LAUNCH-SC-1		-RF (L&IOC)	Assumes XRSN-A, XPNDR-A, MGA-A	Recover current side or failover redunadant side	Draft Complete	CXBROADSIDE, CXRSNBOMNI	Sims 6 & 7
1.2.4	Yes	1	Identify Anomaly	RF-LAUNCH-MV-1		-No Data (good RF)	MV or 1773 problem. Assumes good RF w/ Fill Pattern	Use special commands to recover MV or failover to redundant MV	Draft Complete	N/A (uses Special Commands for recovery)	Sim 6
1.3	Yes	1	Identify Anomaly	Loss of Command RF-UPLK-1	FMEA 1.3, 2.4, 2.6	Loss of Uplk (main)			In Work		
1.3.1	Yes	1	Identify Anomaly	RF-UPLK-GND-1		-Ground	Site is not receiving commands		In Work	N/A	Need test end-to-end with site
1.3.2	Yes	1	Identify Anomaly	RF-UPLK-SC-1		-Spacecraft	Site is receiving commads (S/C downlink is present)		In Work	SXUPLSEL	

2. C&DH

Contingencies

Item	Test Pre Launch	Criticality (1,2,3,4)	Type	ID	FMEA/FTA	Subsystem/Contingency	Description	Action	Flow Chart Status	STOL Procedures	Test Status
2	C&DH										
2.1	Yes	1	Correct Anomaly			Mongoose V µP reset recovery (Cold)	Mongoose Cold reset results on loss of configuration. Need to reestablish the appropriate tables, TSM, RTS, Ephemeris,etc. Evaluates if MV has "2 - Strikes" and considers switching to LMAC MV.	Mongoose Cold reset results on loss of configuration. Need to reestablish the appropriate tables, TSM, RTS, Ephemeris,etc	Complete	CMINIT_ MINIMAL, MD_ DWELLTABLES, SMMTLDUMP, other nominal operations procs	Sim 6
2.2	Yes	1	Correct Anomaly	RF-DNLK_MV-1	FMEA 1.3, 2.1 2.2, 2.4	Mongoose V Failure	Proceed through HW Special Commands to recover MV. Flow ends in "Failover to LMAC MV".	Proceed through HW Special Commands to recover MV. Flow ends in "Failover to LMAC MV".	Complete	N/A (uses Special Commands for recovery)	Sim 6
2.3		2	Correct Anomaly			HKRSN µP Cold Reset recovery	Verify telemetry, reload changes to the htr cycling table	Verify telemetry, reload changes to the htr cycling table	Draft Complete		
2.4		2	Correct Anomaly			MV Warm Reset Recovery	Verify telemetry, and reconfigures MV to pre Warm state	Verify telemetry, and reconfigures MV to pre Warm state	In Work	Under Development:	
2.5		3	Correct Anomaly		FMEA 2.4, 4.1	1773 Bus Errors	Fault on the 1773 Bus	Switch to Alternate Configuration	N/A	CMXBBUSSEL	
2.6		3	Correct Anomaly		FMEA 2.3, 2.3.07, 2.4	HK RSN	RF Switch Failure Driver or telemtry monitor failure	For telemetry use actual transmitter performance as indication, Needs to be Reset	N/A		

3. Deployment

Contingencies

Item	Test Pre Launch	Criticality (1,2,3,4)	Type	ID	FMEA/FTA	Subsystem/Contingency	Description	Action	Flow Chart Status	STOL Procedures	Test Status
3	**Solar Array Deployment**										
3.1	Yes	1	Identify Anomaly	DEPLOY	FMEA 1.3, 2.3	-Arrays did not deploy	Overall Flow chart		Complete	PRI_DEPLOY_POWER_ON, PRI_DEPLOY_POWER_OFF ,FIRE_BOTH_HKRSN, FIRE_PRI_MAC_ACE, FIRE_RED_LMAC_ACE, SWITCH_LMAC_ACE_ON	Sim 6 and S/C contingency testing
3.2		3	Correct Anomaly			-Arrays not fully deployed		Shake S/C via wheels, thrusters; activate damper htrs	In Work	SA_DAMPER_HTR_ON CA_SHAKEARRAY_RWA, CA_SHAKEARRY_THRUSTER	contingency testing
3.3		3	Correct Anomaly			-Still Undeployed	Point a panel to sun	Rotate S/C into sun?	In Work		

4. ACS

Contingencies

Item	Test Pre Launch	Criticality (1,2,3,4)	Type	ID	FMEA/FTA	Subsystem/Contingency	Description	Action	Flow Chart Status	STOL Procedures	Test Status
4	ACS										
4.1	Yes	2	Identify Anomaly			Identify Stable Sunsafe Attitude	Top level flow chart that guides an operator through the checks to verify that the Spacecraft is in "Stable Control Mode". If not this chart branches to an appropriate contingency procedure. Based on the baseline nominal configuration without preexisting	Command Alternate Configuraton	Draft Complete		Sim 6
4.2	Yes	2	Correct Anomaly	ACS-TIPOFF-1	FMEA 2.3	High Tip-Off Rates (main)	For momemtum greater than what Sun Acq can absorb. Let the spacecraft try to capture if it can in 6 to 10 min, then start a thruster unload.	Command Momentum Unload	Draft Complete		
4.2.1	Yes	2	Correct Anomaly	ACS-TIPOFF-2		- ACS ΔH (>2σ rates)	Actual procedure that performs a momentum unload		Draft Complete	CA_MACSDELTAH	Sim 2 (used I&T procs)
4.2.2	Yes	2	Correct Anomaly	ACS-TIPOFF-3		- Manual (ground) ΔH (ACE in Sfhld)	Ground commanded one shots for the thruster. Ground decides which thruster to fire.		Draft Complete	CA_ACEDELTAH	
4.3	Yes	1	Correct Anomaly	ACS-ACE-1	FMEA 1.3, 2.3, 3.1, 3.2, 3.5	MAC ACE data (launch)	Ace Failure, Not sure how different from the one below:		In Work	SA_LMACACEPWRON	
4.4	Yes	3	Correct Anomaly		FMEA 2.3, 2.5, 3.1	LMAC ACE Failure. Done by TSM/FDC	Bad data, not executing commands, etc	Command Redundant ACE	In Work		

4. ACS (cont.)

Contingencies

Item	Test Pre Launch	Criticality (1,2,3,4)	Type	ID	FMEA/FTA	Subsystem/Contingency	Description	Action	Flow Chart Status	STOL Procedures	Test Status
4.5		2	Identify Anomaly	ACS-MAN-1		Maneuver (main) (for ongoing S/C maneuver)	Main flowchart for following and troubleshooting a maneuver. Refers to others below once anomaly found.	Need to replan a maneuver, starting at the beginning of the process.	Draft Complete	N/A	
4.6		3	Correct Anomaly			Momentum Build Up	Provide decision flow to allow increased torque to wheels, momentum unload to an offset, etc	Extend period between momentum unloads	Draft Complete		
4.7		3	Correct Anomaly	ACS-EPH-1		Bad Ephemeris		Reload Ephemeris	Draft Complete		
4.9		3	Correct Anomaly	ACS-KF-1		Kalman Filter diverged	Determine what caused the divergence		Draft Complete		
4.11	Yes	2	Correct Anomaly		FTA 3	S/C lost Attitude Reference during Maneuver Sequence.	Use of ground tools to recreate a best estimate or abort the burn.	Potential problem with re establishing an attitude reference in the radiation belts after attitude reference is lost. AST may not work.	Draft Complete		
4.12	Yes	1	Correct Anomaly	ACS-RWA-1	FMEA 1.3, 3.1, 3.4	Wheel Failure	Identify cause of wheel failure (Runs up, Stops torquing, freezes, incorrect torque, ACE failure)	Generally Safehold/CSS. Uplink new softare. Phasing loop configure how to do slew to the required atitudes maneuvers on two wheels.	Draft Complete	CA_GOSH	Two Wheel Control patch written & tested by FSW test team
4.13		3	Correct Anomaly	ACS-RWA-2		Wheel Polarity or thruster Polarity	If there is a phasing problem prepare to correct an alignment matrix	Prepare for loading tables to change matrix	Draft Complete		

4. ACS (cont.)

Contingencies

Item	Test Pre Launch	Criticality (1,2,3,4)	Type	ID	FMEA/FTA	Subsystem/Contingency	Description	Action	Flow Chart Status	STOL Procedures	Test Status
4.14	Yes	2	Correct Anomaly	ACS-CSS-1	FMEA 1.6.02	CSS Failure	Identify and determine if switching the redundant ACE is necessary.		Draft Complete		
4.18a	Yes	2	Correct Anomaly	ACS-IRU-1		IRU Failure	Determine what should be done based on mission phase.	Use of the DSS for backup rate source. Command Redundant IRU.	In Work		Sims 2b-2f
4.18b	Yes	2	Correct Anomaly	ACS-IRU-1 (Launch)		IRU Failure (launch)	Determine what should be done during separation acquisition. ACE Coldstart and gyros off.	Use of the DSS for backup rate source. Command Redundant IRU.	Draft Complete		
4.15	Yes	2	Correct Anomaly			Safehold Recovery		Run through the necessary steps.	Draft Complete	SA_EXITSH, SA_GOSUNACQ	Tested w/ FlatSat during Mission Sim #2
4.16	Yes	2	Correct Anomaly			ACE μP Cold Reset recovery. Need diagnosis.		Run through the necessary steps.	In Work		
4.17	Yes	1	Correct Anomaly			Power Off / On ACS component via both ACEs	ACS Components powered from redundant sources need to be powered off. Gyros powered from both sides	Use of a raw bus command command the power off from the alternate ACS without disruptions that cause Safehold.	In Work	M2FACS_ALTACECMD	
4.19		3	Correct Anomaly			MAC Ace Fails while LMAC in control	"Hot Backup" ACE is failed, FDC should not switch to it.	Disable FDC the switches to the MAC ACE	In Work		
4.21		3	Correct Anomaly			AST Anomally			Draft Complete		
4.22		3	Correct Anomaly			Sun on single panel		Send a command to put sun on a single panel. GND 0001, I no bias	In Work		

5. Maneuver Planning

Contingencies

Item	Test Pre Launch	Criticality (1,2,3,4)	Type	ID	FMEA/FTA	Subsystem/Contingency	Description	Action	Flow Chart Status	STOL Procedures	Test Status
5	**Manuver Planning**										
5.1	Yes	2		MANEUVER-1		Maneuver Planning Overall Flow (inc. Cal, Perigee, Apogee, L2)	Overall process flow		Draft Complete	N/A	Every Maneuver Sim
5.2 (6.	Yes	2				Thruster Failure (planning)	Given what has happened decide ACS backup of Delta V configurations. (Decide reburn options and costs.)	Reconfigure spacecraft for remaining thrusters. Replan maneuver (or trajectory), if necessary. NEED BURN ABORT CRITERA.	In Work (Combined effort Manuever & Propulsion)	None yet.	Sim 6a
5.3		3				Missing all perigee burns			In Work		
5.3a		3				Missing P1	Determine if it was s/c anomaly or not. Determine if P2 and Pf can makeup lost bun.	Replan trajectory with P2 and Pf burns. Reestimate fuel use.	In Work	N/A	Sims 2b-2f
5.3b	Yes	2				Missing Pf	Determine if s/c anomaly, and whether to reburn, or wait until PfCM.	Replan Pf and PfCM burns, reconfigure s/c if necessary.	Draft Complete	N/A	
5.4		3				LV injection orbit error $>3\sigma$			In Work		
5.5		3				Maneuver Planning Tools / Computer Down	Implement backup computer to plan maneuvers	Replan with backup machines.	In Work	N/A	Needs to be tested in Trajectory sims and Mission sims.
5.5a	Yes	2				NavGSE	Implement backup computer to plan maneuvers	Replan with backup machines.	In Work	N/A	Needs to be tested in Trajectory sims and Mission sims.
5.5b		3				MatrixX	Implement backup computer to plan maneuvers	Replan with backup machines.	In Work	N/A	Needs to be tested in Trajectory sims and Mission sims.
5.5c	Yes	2				Astrogator	Implement backup computer to plan maneuvers	Replan with backup machines.	In Work	N/A	Needs to be tested in Trajectory sims and Mission sims.
5.5d		3				FlatSat	No ATS, CQT testing before maneuver.	?	In Work	N/A	Needs to be tested in Trajectory sims and Mission sims.

5. Maneuver Planning (cont.)

Contingencies

Item	Test Pre Launch	Criticality (1,2,3,4)	Type	ID	FMEA/FTA	Subsystem/Contingency	Description	Action	Flow Chart Status	STOL Procedures	Test Status
5.6		3				Calibration Burn Results	Plan for incorporating result of calibration maneuvers into maneuver planning tools. Durty cycle not as expected.				Requires database update for mass
5.7		NA			FTA 5.1	Planning Error	a. Difference between Model and S/C Configuration b. Difference in Orbital Location of Delta V c. Wrong or Outdated S/C, Orbit or Maneuver File d. Orbit Propagation Error e. Error in S/C Thruster, f. Error in Fuel Usage Model g. Error in Mass Properties				
5.8		NA			FTA 5.2	Navigation Error	a. Tracking State Unavailable b. Insufficient Ranging Data c. Ground System Inoperable d. Large Errors in Tracking Data e. Noise from S/C or Ground System f. Modeling Errors g. Effects of Thrusters (ACS, Momentum Unload) h. Effects of Small Forces i. Wron	Place item "G" in normal ops flow chart 5.1			

6. Propulsion

Contingencies

Item	Test Pre Launch	Criticality (1,2,3,4)	Type	ID	FMEA/FTA	Subsystem/Contingency	Description	Action	Flow Chart Status	STOL Procedures	Test Status
6	Propulsion										
6.1 (5.	Yes	2		PROP-THR-1		Thruster Failure (S/C), and fuel leak.	Procedure or flow that documents what happens (checked on Hi Fi) for each thruster failure and what should be done for each thruster failure.	Select Alternate Thruster / close I/V is case of a leak / use other ACE if electrical failure / troubleshoot using one-shots / etc. NEED BURN ABORT CRITERA	Draft Complete	ca_thruster_test, ca_propcfg, ca_macs_thruster_reconfig	Sim 6a
6.3		3		PROP-TMP-1		Valve Temperature		Change heater configuration	Draft Complete	N/A; discrete commands only	N/A (thermal balance testing)
6.4		3		PROP-TMP-2		Tank/Line Temperature		Change heater configuration	Draft Complete	N/A; discrete commands only	N/A (thermal balance testing)
6.5		3		PROP-PRES-1		Pressure Transducer		Utilize Backup Fuel Accounting	Draft Complete	N/A; discrete commands only	N/A (analysis only)
6.6		3		PROP-ISO-1		Isolation Valve Closed		Open Isol Valve	Draft Complete	N/A; discrete commands only	
6.7		3		PROP-TMP-3		Heater Cycling		Change heater configuration	Draft Complete	N/A; discrete commands only	

7. Power, PSE

Contingencies

Item	Test Pre Launch	Criticality (1,2,3,4)	Type	ID	FMEA/FTA	Subsystem/Contingency	Description	Action	Flow Chart Status	STOL Procedures	Test Status
7	**Power PSE**										
7.1	Yes	1	Identify Anomaly	PSE-PWR-POS-1		Identify Power Positive State	Flow chart to determine if the S/C is "Power Positive", and if the Control Mode (Current, VT, Trickle) has the correct setpoints. If it is not power positive, the logic attempts to obtain a corrective solution -or- it branches to a more applicable conting	Command Configuration & Try Alternates	Draft Complete	spsevt.prc spsedesi.prc spsecd.prc spsetrki.prc cpse_undo_rts59	Sim 6 & 7
7.2		3	Identify Anomaly	PSE-BAT-1		Battery Monitoring (Voltage, Temperature, Differential Voltage, Charge/Discharge Nominal, State of Health)	Top-Level' flowchart calls on sub-flowcharts for specific battery failure scenario.	Command Configuration & Try Alternates -else- Safe the S/C.	Draft Complete	spsevt.prc spsedesi.prc spsecd.prc spsetrki.prc	Flow Chart requires review only
7.3		3		PSE-OM-1		SSPC Monitoring	Flow chart steps operator through logic to identify and correct for SSPC error or misconfiguration.	Verify nominal state -else- determine cause of anomoly and return to proper configuration of SSPC.	Draft Complete	spsspc.prc	Flow Chart requires review only
7.4		3		PSE-LVPC-1		LVPC Monitoring	Flow chart steps operator through logic to identify and correct for LVPC error or misconfiguration.	Verify nominal state -else- determine cause of anomoly and return to proper configuration of LVPC.	Draft Complete	splvpctrp.prc splvpc.prc	Flow Chart requires review only
7.5		3	Identify Anomaly	PSE-SA-1	FMEA 1.1, 1.2.16, 1.4.16	Solar Array Monitoring, and control loop failure	Flow chart that checks likely hardware and software failures or misconfigurations on the S/C regarding the solar array. It then attempts to correct the problem -or- branches to a more applicable contingency procedure. Loss of Battery Voltage or Current S	Command Configuration & Try Alternates. Ground based control of Solar Array Segments or Use of SAM Analog Backup based on bus voltage clamp	Draft Complete	cpse_undo_rts59 cpsasegmsk.prc spwrst.prc spcrst.prc	Flow Chart requires review only
7.6		3	Identify Anomaly	PSE-RSN-1		RSN Failure	Flow chart that checks likely PSE RSN failures. Through logic, it attempts to identify, then provide possible solution to correct anomaly.	Activate Analog Backup on S/A Module	Draft Complete	cprtrst.prc cpscmd1.prc spwrst.prc spcrst.prc	Sim 4b Flow Chart requires review only
7.7		3		PSE-RSN-2		PSE RSN μP Cold Reset recovery	STOL procedure that should be executed following an unexpected PSE Cold Restart.	Reconfigures PSE after cold restart.	Draft Complete	cplconfig.prc spsocinit.prc spsevt.prc spsspc.prc splvpc.prc salvpcserv.prc spsspc.prc shlvpcserv.prc .	Flow Chart requires review only

8. Instrument

Contingencies

Item	Test Pre Launch	Criticality (1,2,3,4)	Type	ID	FMEA/FTA	Subsystem/Contingency	Description	Action	Flow Chart Status	STOL Procedures	Test Status
8	Instrument										
8.1	Yes	1	Identify Anomaly	INST-1		Drain Current Limit Violation	Any Yellow or Red, High or Low drain Current Limit Violation	Identify type of limit violation and review data to determine the cause.	In Work	m2cdhemtonoff m2cdeepromcmlist m2cdrstbiasvolt m2cdrebiasfixedgate m2cdrebiascmdablegate m2cdldeepromfixedgate m2cdhkpatch	
8.2	Yes	1	Identify Anomaly	INST-2		DEU Software Reset	Telemetry indicates that a warm/cold/watchdog reset has occurred.	Review spacecraft and instrument health. Monitor.	In Work	m2cdcoldrst m2cdsftwarerst m2cdwarmrst	
8.3	Yes	1	Identify Anomaly	INST-3		Step/Jump in Telemetry	After reviewing trend plots a step or jump is observed in housekeeping or science telemetry.	Science team to monitor and analyze.	In Work	m2cd1ampiv m2cdpolarampiv m2cdpatchhk	
8.4	Yes	1	Identify Anomaly	INST-4		Corrupted Housekeeping or Science Packets	Receipt of corrupted packet/bad packet checksum	Review health and safety of Instrument and Observatory status. Determine if any action is necessary.	In Work	m2cdcoldrst m2cdsftwarerst m2cdwarmrst	
8.5	Yes	1	Identify Anomaly	INST-5		Instrument is Off	The Instrument is found off after a pass	Identify what mechanism turned off Instrument. Turn the Instrument on as soon as possible.	In Work	m2pdinston	
8.6	Yes	1	Identify Anomaly	INST-6	FMEA 1.3, 4.6	Instrument electronics is off and getting cold	Either the Instrument is partially or completely powered off. Determine if make-up heaters are necessary.	Determine how much of the Instrument is powered off. Turn on make-up heaters.	In Work	m2cdpduhtron m2cdrxbhtron	
8.7	Yes	1	Identify Anomaly	INST-7		Poor Instrument Performance	After analyzing science data a radiometer is found to have either high noise or low gain	Adjust bias voltage settings. Science team to provide parameters to be used for this procedure. Re-evaluate instrument performance.	In Work	m2cdeepromcmlist m2cdrstbiasvolt m2cdrebiasfixedgate m2cdrebiascmdablegate m2cdldeepromfixedgate	
8.8	Yes	3	Identify Anomaly	INST-8		Data Flow Problem from the SMOC to OMEGA	Data is not flowing correctly from the SMOC to OMEGA	Step through data flow to correct.	In Work	n/a	

9. Thermal

Contingencies

Item	Test Pre Launch	Criticality (1,2,3,4)	Type	ID	FMEA/FTA	Subsystem/Contingency	Description	Action	Flow Chart Status	STOL Procedures	Test Status
9	Thermal										
9.1		3			FMEA 2.3.32	Temperatures out of Range		Command Heater Configurations	In Work	In Work	

10. Launch-Site (Pad)

Contingencies

Item	Test Pre Launch	Criticality (1,2,3,4)	Type	ID	FMEA/FTA	Subsystem/Contingency	Description	Action	Flow Chart Status	STOL Procedures	Test Status
10	Launch - Site (PAD)										
10.1		2				Fairing Air Conditioning	Fairing air temp increase or failure	Request lower temp;Power off Instrument;reduce battery I	In Work	m2sdinstoff, and spsetrki	
10.2		2				GN_2 Purge Outage	Battery GN2 Outage or reduction	Request lower fairing air temp;Reduce Battery Desired I in PSE;power off instrument	In Work	m2sdinstoff	
10.3	Yes	1				Battery Temperature Rising		Reduce Battery Desired I in PSE	Complete	spsevt, spsetrki	Sim 6 & 7
10.4	Yes	1				Launch Recycle	Needed if Launch Window exceeds 10 min?	Reset Timers for Launch	In Work	m2solaunch_gsfc,m2solaunch_ksc	Test during Launch Sim(s)
10.5	Yes	1				Storm, Lightning Alert		Power off S/C if lightning within 5 miles	Complete	m2cppwroff; in review	MAP Lightning Plan, In Review
10.6	Yes	1				Emergency Power Off		Emergency off via STOL or Umbilical	N/A	m2cppwroff	contingency testing
10.7	Yes	1				Umbilical Computer Failure		Switch in redundant computer	In Work	N/A	Sim 6
10.8	Yes	1				Scrub/Turnaround			In Work		
10.9	Yes	1				Prop Tank Temp and Pressure increasing			In Work	N/A	
10.10		3				Emergency propelant offload			In Work		

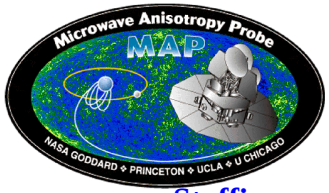
11. SMOC/Control Center

Contingencies

Item	Test Pre Launch	Criticality (1,2,3,4)	Type	ID	FMEA/FTA	Subsystem/Contingency	Description	Action	Flow Chart Status	STOL Procedures	Test Status
11	SMOC / Control Center										
11.1	Yes	4				Primary Workstation Failure		Configure Sgse4 as Primary Workstation	Complete	cgpwf	Sim 6, ETE testing
11.2	Yes	4				FEDS Failure		Configure lfeds4 as mapfeds5	Complete	cgff	ETE testing
11.3	Yes	4				Power Failure		system power is on UPS	Complete	N/A	N/A
11.4	Yes	4				Network element Failure		Switch over to backup	Complete	cgnef	ETE testing
11.5	Yes	4				Secondary Workstation Failure (Traj Planning, NAVGSE, etc)		Switch to the backup systems	In Work	N/A	
11.6	Yes	4				Secondary Workstation Failure (Prior to launch)		Switch to the backup systems	In Work	N/A	

Staffing & Facilities

Those Who Drive The Bus



Staffing and Facilities

Staffing Overview

Subsystem Staffing Overview:

Mission Day	Pre-Launch L-12 to L+0	IOC L+0 to L+34				Cruise L+35 to L+90	L2 Ops L+91 to EOL	
		IOC Ops L+0 to L+7	Manuever Ops Perigee Coincidence	Nominal Pass Ops L+7 to L+34	Special Ops - Mid-Course Correction	Nominal Pass Ops L+35 to L+90	Normal Routine Operations with Automation Tested	Delta-V Operations
SMOC	- Primary Control Site - SCT 24 hours/day - System Support All Pad Testing - Subsystem Support All Pad Testing - Maneuver Team Day Shift off-line analysis	- Primary Control Site - SCT 24 hours/day - System Support 24/day - All Subsystems Support 24/day - Maneuver Team 24/day off-line analysis	- Primary Control Site - SCT 24 hours/day - System Support 24/day - Subsystem Support ASC/FSW/Prop 24/day Others: 12/day - Maneuver Team 24/day off-line analysis	- Primary Control Site - SCT 24 hours/day - System Support 12/day - Subsystem Support ASC/FSW Day/Swing Shift Others: Day Shift - Maneuver Team Day/Swing Shift off-line analysis	- Primary Control Site - SCT 24 hours/day - System Support 12/day - Subsystem Support ASC/FSW/Prop 12/day Others: as needed - Maneuver Team 12/day off-line analysis	- Primary Control Site - SCT Day/Swing Shift - System Support as needed - Subsystem Support as needed - Maneuver Team Day Shift off-line analysis	- Primary Control Site - SCT Day Shift - System Support as needed - Subsystem Support as needed - Maneuver Team One Day/Week off-line analysis	- Primary Control Site - SCT 2 Shifts - System Support as needed - Subsystem Support ASC/FSW/Prop 12/day - Maneuver Team 12/day off-line analysis
MITOC	- 2nd Backup Control - 4 Instr Controllers & Science Team All Pad Testing - GS Developers Day Shift	- 2nd Backup Control - 4 Instr Controllers & Science Team 24/day - GS Developers Day Shift	- 2nd Backup Control - 4 Instr Controllers & Science Team 12/day - GS Developers Day Shift	- 2nd Backup Control - 4 Instr Controllers & Science Team Day Shift - GS Developers Day Shift	- Backup Control Site - Available if needed			
CAPE	- 3rd Backup Control - SCT 24/Day - Power & Systems for all Pad Testing - on call at other times							
Block House	2 people 24/Day							

Power-On & Launch Crews (1/2)

Staffing and Facilities

Position	Location	Power-On Shift	Launch Shift	Flex Shift
MAP Program Manager	KSC MDC	N/S	L. Citrin	
Principle Investigator	KSC MDC	N/S	C. Bennett	
Safety & System Assurance	KSC MDC	N/S	R. Kolecki	
Launch Vehicle Integrator	KSC MDC		T. Ajluni	
KSC Systems Engineer	KSC SAEF-2	G. Shiblie	L. Bartusek	G. Meadows
KSC Battery Manager	KSC SAEF-2	L. Lee	D. Radzykewycz	
KSC Quality Assurance	KSC SAEF-2	J. Klein	K. Corsi	
EGSE Engineer	Blockhouse	K. Rush	R. Miller	
KSC Electrical Technician	Blockhouse	V. McCarter	E. Whittington	
GSFC Systems Engineer	GSFC SMOC	S. Glockner	J. Ruffa	M. Bay
GSFC Systems Engineer	GSFC SMOC			C. Jackson
GSFC ACS1	GSFC SMOC	J. O'Donnel	D. Ward	
GSFC ACS2	GSFC SMOC	D. Henretty/S. Starin	S. Andrews	
GSFC C&DH	GSFC SMOC	S. Schumacher / T. Nengers	J. McCabe / M. Lin	
GSFC Delpoyables	GSFC SMOC	A. Stewart *	A. Stewart	
GSFC Flight Software	GSFC SMOC	J Wu / S. Calder	J.Marquart/M.Bartholomew	
GSFC Instrument	GSFC MITOC	S. Meyers	G. Hinshaw	E. Wollack
GSFC Instrument Support	GSFC MITOC	L. Page	G. Tucker	
GSFC Propulsion	GSFC SMOC	R. Estes	G. Davis	
GSFC Power	GSFC SMOC	W. Alsback	D. Yun /K. Smithgall	
GSFC Quality Assurance	GSFC MITOC	A. Lacks	W. Jones	
GSFC RF	GSFC SMOC	A. Rodriguez-Arroyo	M. Powers	
GSFC Thermal	GSFC SMOC	N/S	S. Glazer	
GSFC Thermal	GSFC MITOC	K. Brown	W. Ancarro	

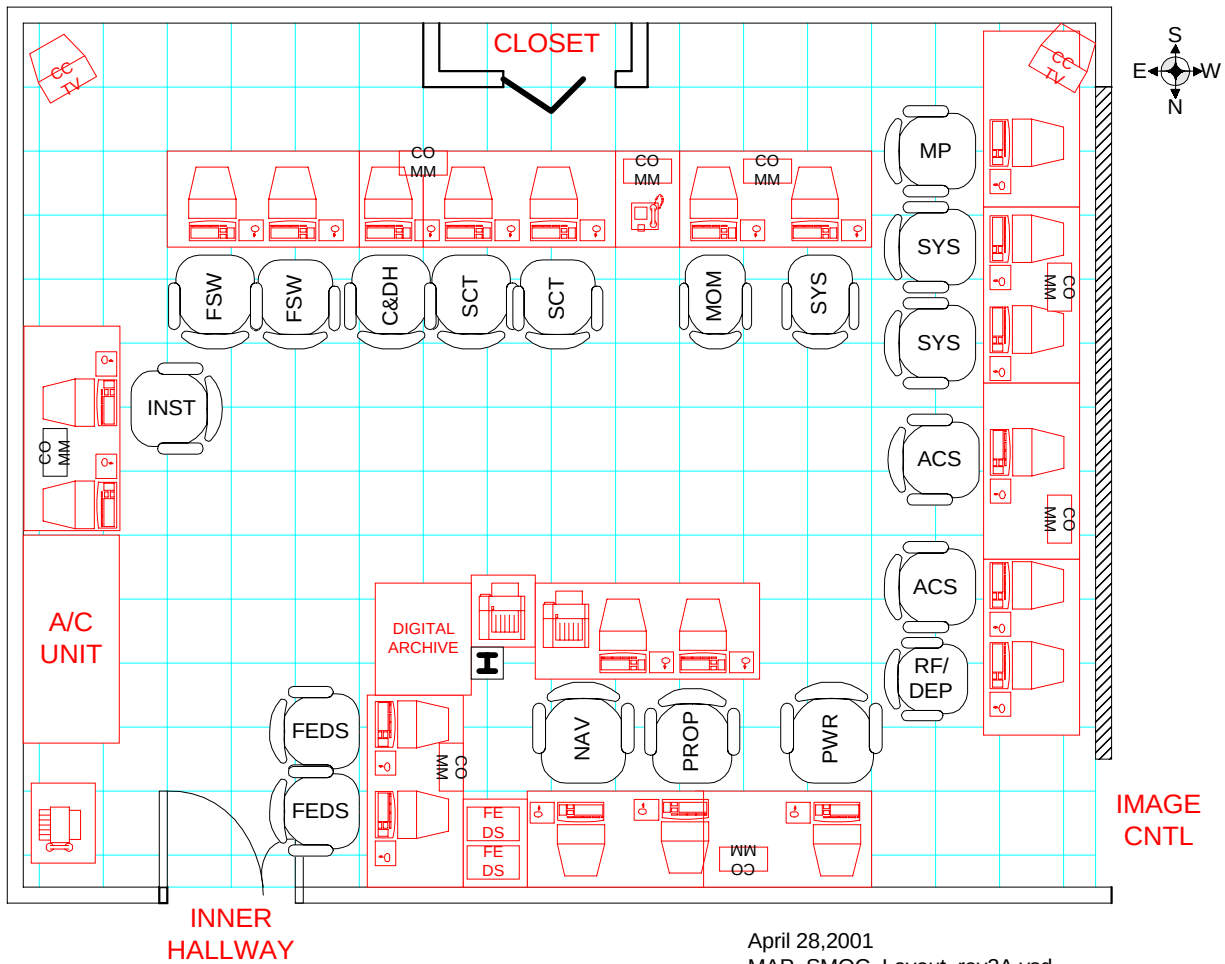
Power-On & Launch Crews (2/2)

Position	Location	Power-On Shift	Launch Shift	Flex Shift
Mission Operations Manager	GSFC SMOC	C. Gustafson	S. Coyle	
Network Director	GSFC SMOC			
KSC Ground Support Engineer	KSC SAEF-2	T. Bialas	T. Bialas	
GSFC Ground Support Engineer	GSFC SMOC	T. Green	T. Green	
GSFC Trajectory	GSFC MAR	M. Woodward	O. Cuevas/M.Mesarch	
KSC Operations Controller	KSC SAEF-2	K. Blahut	R. Shendock	
KSC Command Controller	KSC SAEF-2	N. Gray	M. Lacombe	
SCT Spacecraft Systems	GSFC SMOC	P. Gonzales	J. Pepoy	
SCT Operations Controller	GSFC SMOC	B. Parker	G. Miller	
SCT Command Controller	GSFC SMOC	L. Rhodes	G. Wofford	
SCT Mission Planning Analyst	GSFC SMOC		M. Paoletta	
SCT Navigation Analyst	GSFC SMOC	B Twambly	D. Fink	
SCT Instrument Controller	GSFC MAR		L. Reichenthal	

Launch & Operations Support Facilities
GSFC Science & Mission Ops Center

Staffing and Facilities

ROOM S25B (SMOC) IN BUILDING 3



April 28,2001
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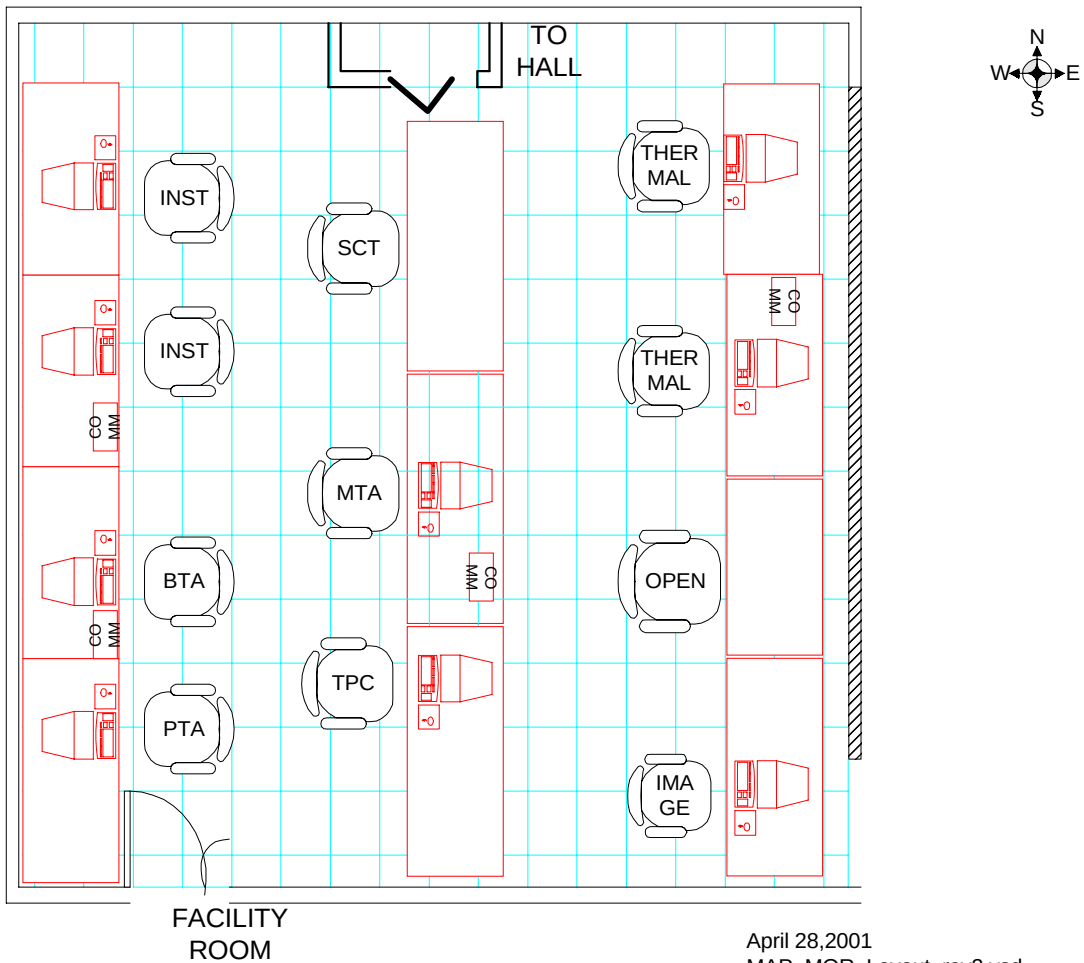
Launch & Operations Support Facilities
GSFC Mission Analysis Room

Staffing and Facilities

ROOM S25D (MOR) IN BUILDING 3



April 28,2001
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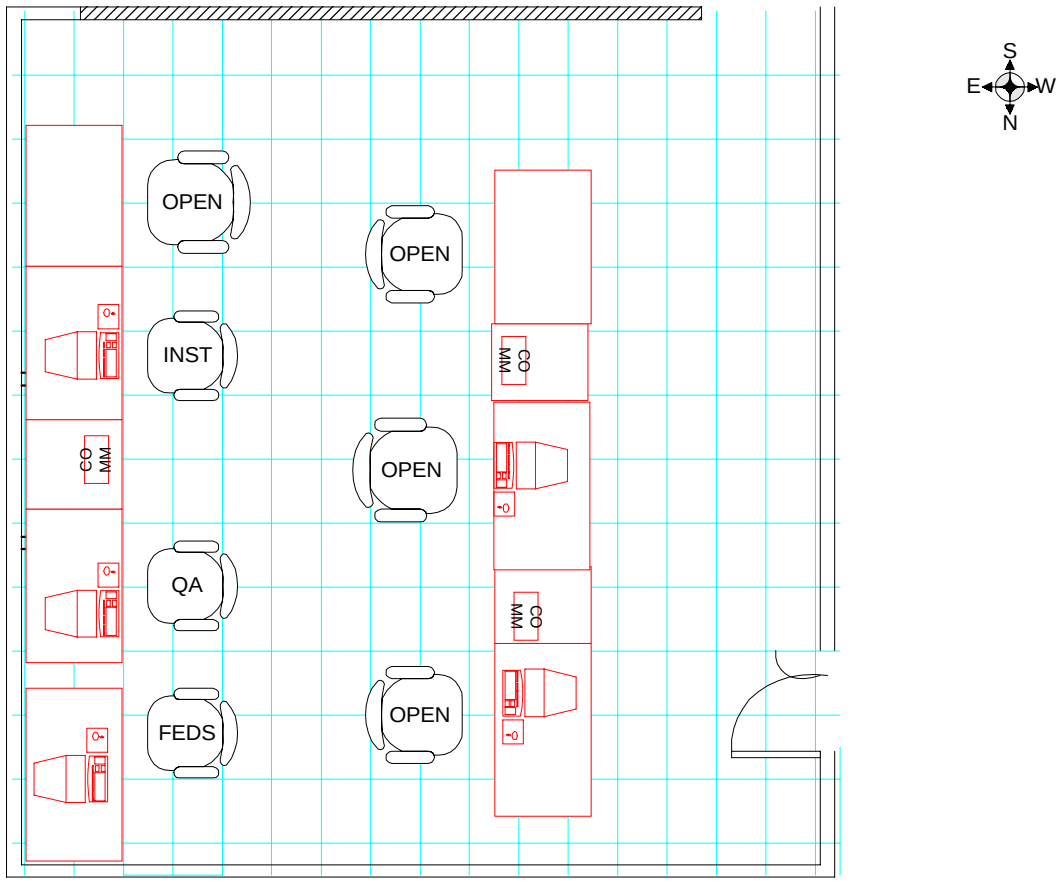
Launch & Operations Support Facilities
GSFC MAP Integration Test & Ops Center

Staffing and Facilities

ROOM 150 (MITOC) IN BUILDING 29



April 28,2001
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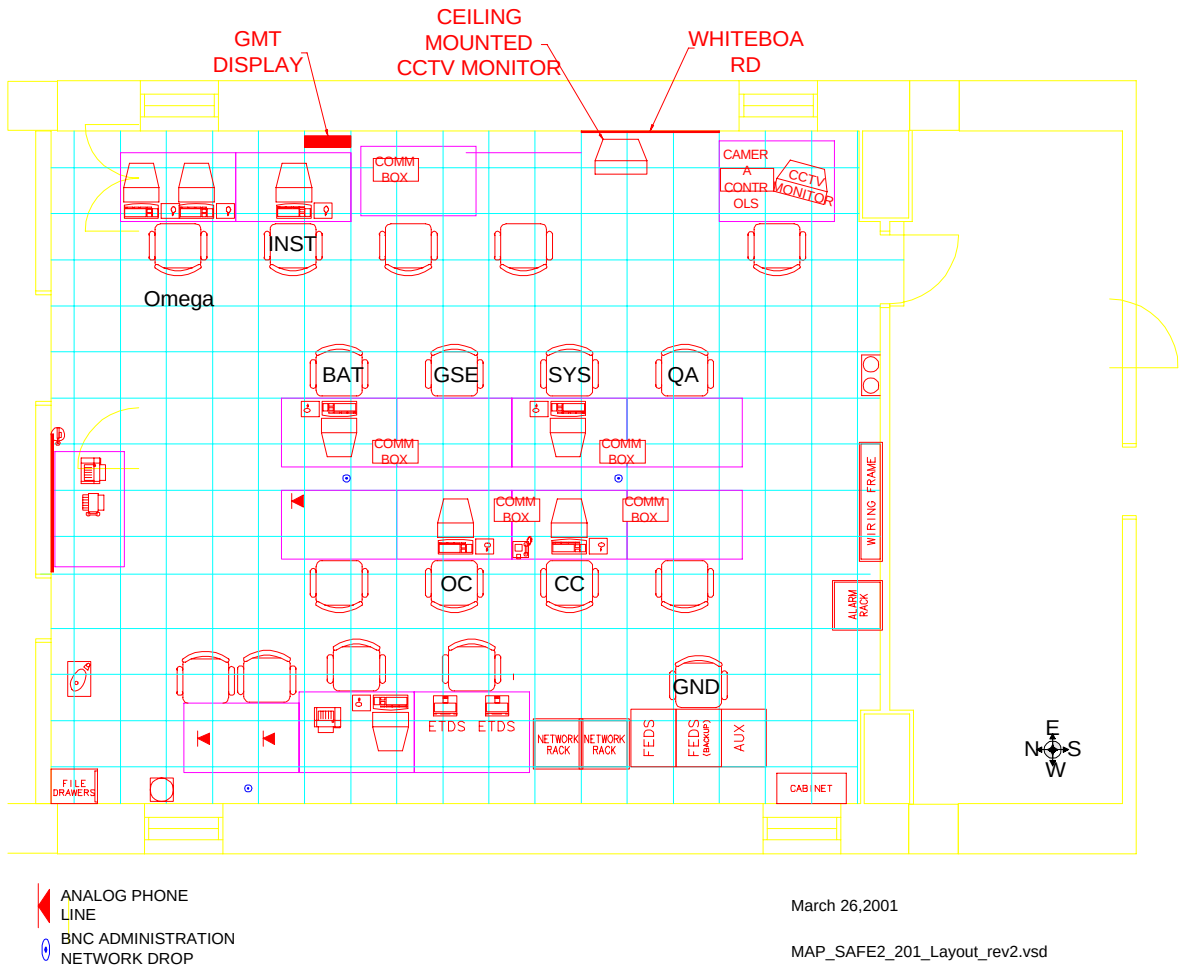
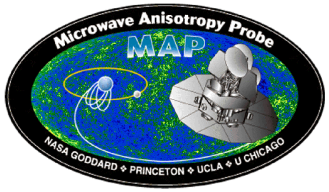
Launch Support Facilities
KSC Spacecraft Control Room

Staffing and Facilities



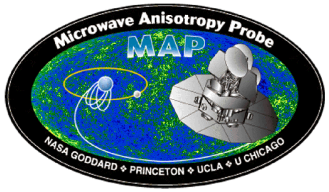


Launch Day Staffing Plan

- Launch Day Team Structure and Facilities:
  - Two supporting shifts: Power-On and Launch
  - Utilize SMOC, MAR, MITOC and KSC
- Schedule Overview
  - Power-On Team
    - KSC Eng & KSC SCT — L-12 hr to L-0:00 hr
    - KSC Systems & Goddard SCT — L-12 hr to L-2:30 hr
    - Goddard Systems & Eng — L-10:30 to L-2:30 hr
  - Launch Team
    - KSC Systems & Eng KSC & GSFC SCT — L- 4 hr to Power +
    - Goddard SCT — L- 4 hr to L+8 hrs
    - Goddard Systems & Eng — L- 4 hs to EOS

Launch Management

Steven Coyle



Launch Commit Criteria

- **Spacecraft**
  - Successful Pad functional test
  - Observatory is in launch configuration and state-of-health verified through telemetry
  - No red or unexplainable yellow limits
  - Launch team must confirm nominal spacecraft performance
- **Instrument**
  - Successful Pad functional test
    - The instrument is not powered at launch

Launch Commit Criteria

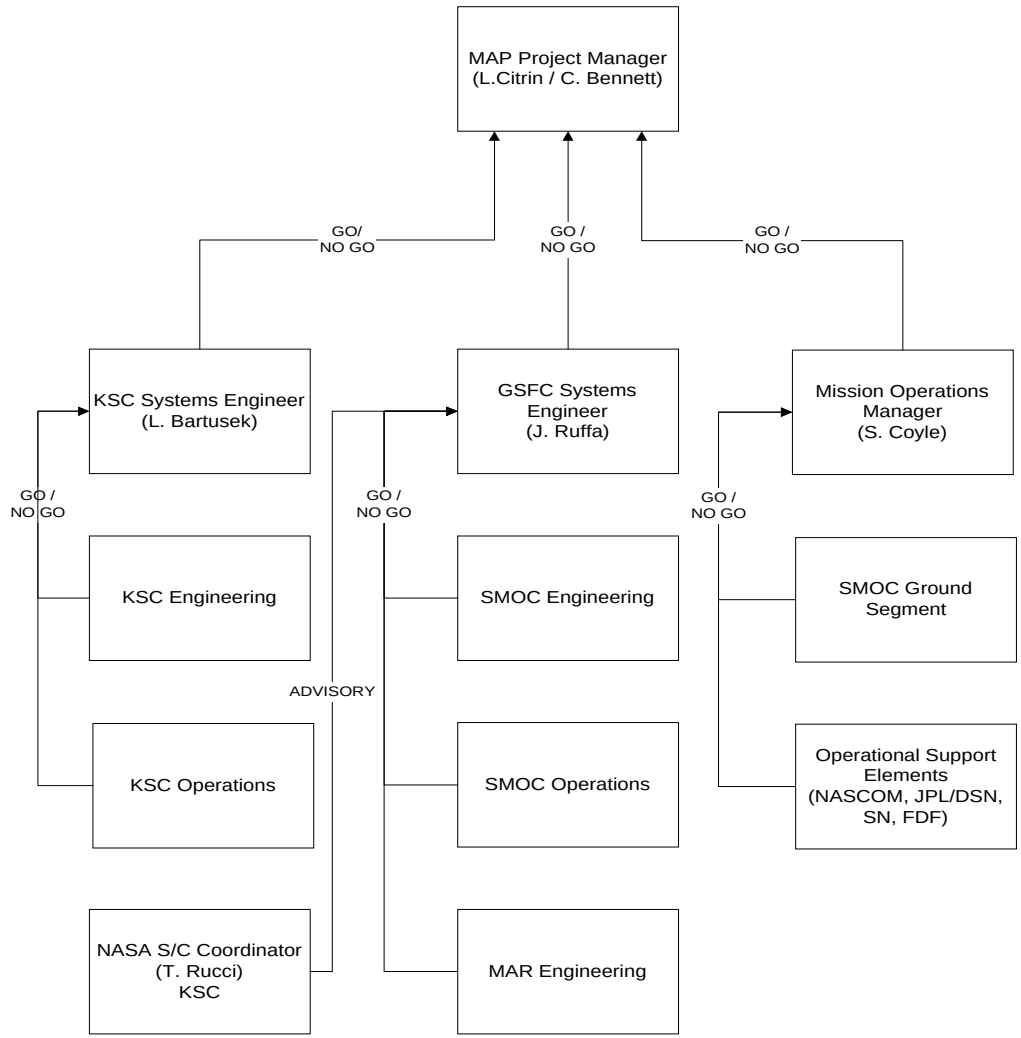
- **Ground System**
  - **SMOC**
    - Must be able to process telemetry and execute commands to maintain the observatory in a safe operational mode
  - **SAEF-2 (Room 201)**
    - Must be able to process telemetry and execute commands to maintain the observatory in a safe operational mode
  - **MMFD** (FDF)
    - Must be prepared to preprocess DSN tracking data and deliver the data to the SMOC

Launch Commit Criteria

- **Network**
  - **Deep Space Network**
    - Goldstone & Madrid must report in “Green” with at least one station calibrated and operational to support MAP
  - **TDRSS**
    - Configured to provide telemetry and command support during spacecraft separation from the launch vehicle
  - **NASCOM**
    - Voice and data circuits must be fully operational between the SMOC, SEAF-2, TDRSS and the DSN

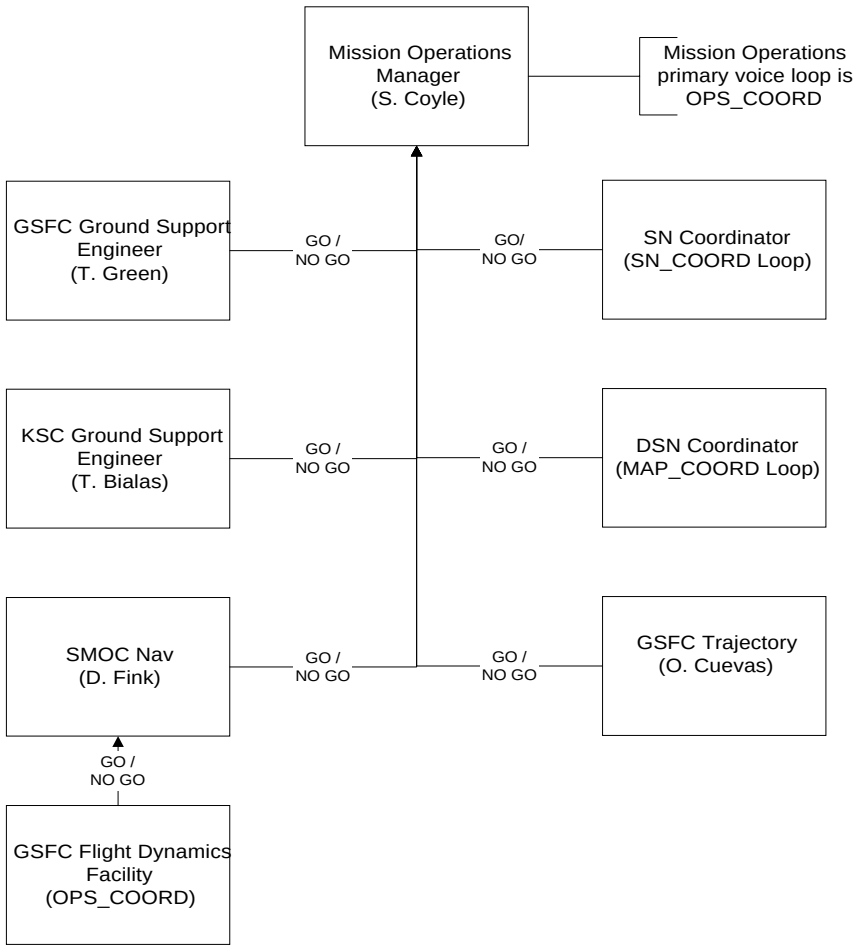
Project Go/No Go

Launch Management



MOM Go/No Go

Launch Management



Controller Team Training

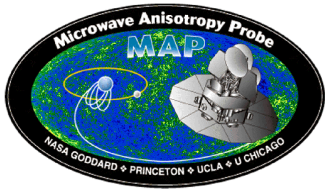
Steven Coyle

Training

- Single Controller Team since the beginning
- Team members gained valuable experience supporting Box level integration and observatory I&T
- Controller Team has participated in 29 of 43 mission and launch simulations
- Countdown rehearsals
- All controllers have passed a 100 question certification exam
- Team will continue to test and exercise procedures using the simulator
- Cross-training is ongoing for all positions

Controller NAC Status

- All the spacecraft controllers have been cleared through the NAC process
  - Written confirmation from Honeywell available



Flight Dynamics Status

Trajectory Status

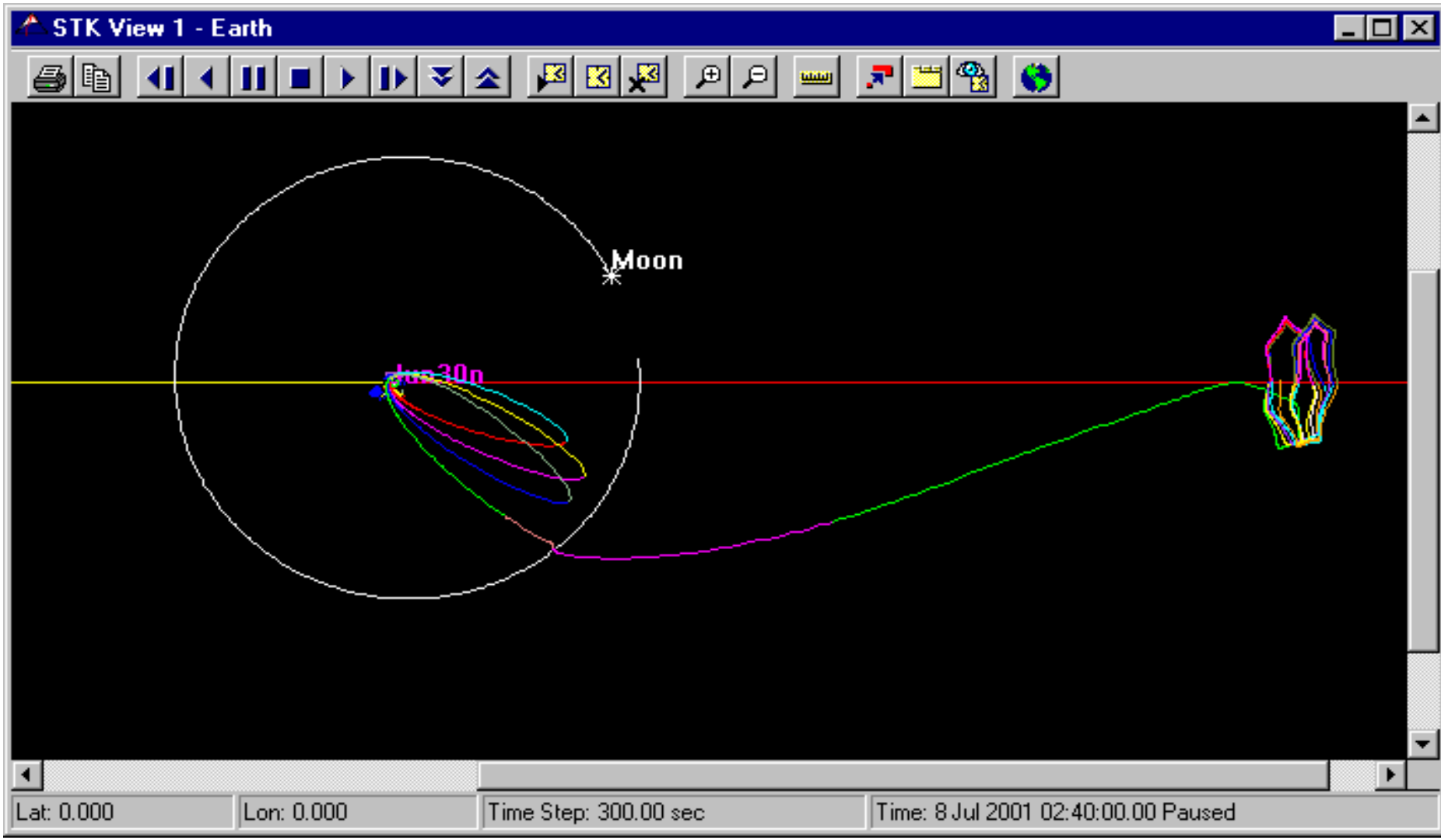
Osvaldo Cuevas

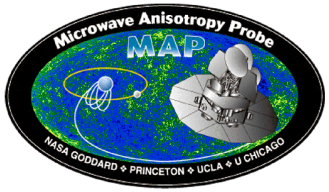
AGENDA

- MAP Trajectory
- DTO Status
- Launch Window Analysis Status
- Operations Readiness
- Trajectory Simulation Status
- Training Matrix Status
- Trajectory Team Staffing
- Transition to Routine Ops

MAP Trajectory
June 30th launch

Trajectory





Timeline for the June 30th Launch (Nominal)

Trajectory

Event	Time	UTC	Notes
Launch	L	6/30@19:46	For June 30, 2001
3rd Stage Burn	L + 70 min	20:66:45	Long coast
Separation	TTI + 5 min	21:16:54	SA deploy right after separation
Cal burns	L + 2 days	TBD	ASAP (Cal Thrustres 5-8 before A1)
A1	L + 3.5 days		Mnvr only if perigee too low
P1	L + 7 days		Incr sma to lunar dist
A2	L + 12 days		No mnvr planned
P2	L + 17 days		No mnvr planned
A3	L + 22 days		No mnvr planned
P3	L + 27 days		Dv req'd
Swingby	L + 30 days	7/30 @ 23:28	No mnvr
MCC	S + 7 days		Current Baseline
L2 Insertion	S + 120 days	12/26@22:55	No mnvr
Stationkeeping	Every 3 months		

DTO Status

Trajectory

- Launch Manifest is June 30th, 2001(beginning of July 3-loops launch block)
  - **All trajectories have a Long coast (approx 516 minutes)**
  - **Target State Information**
    - **Launch window varies each day. Can be between 5 to 25 minutes.**
    - **Injection C3= -2.6 Km^2/sec^2**
    - **Spacecraft = 831kg (835kg)**
    - **Inclination = 27 degrees**
  - **RAAN and AP vary slightly for each launch opportunity**
- All Trajectories from July through Sept (3 & 5 loops) delivered to Boeing.
- Boeing response to our DTO inputs have been received.
- Daily Launch Window for the month of July has been delivered to Boeing.

MAP Daily Launch Period
July (3-loop)

Launch Day	#mins	DTO time (UTC)	Open/Close
June 30	10	19:56:46	19:46:46 – 19:56:46
July 1	10	19:50:11	19:40:11 – 19:50:11
July 2	15	19:44:53	19:34:53 – 19:49:53
July 3	05	19:35:23	19:30:23 – 19:35:23
July 4	15	19:30:17	19:20:17 – 19:35:17
July 5	20	19:29:36	19:24:36 – 19:44:36

MAP Daily Launch Period
July (5-loop)

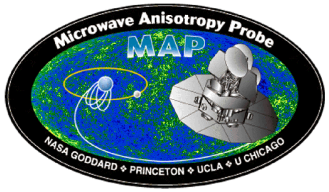
Launch Day	#mins	DTO time (UTC)	Open/Close
July 16	10	20:28:59	20:23:59 – 20:33:59
July 17	25	20:28:59	20:18:59 – 20:43:59
July 18	25	20:23:57	20:13:57 - 20:38:57
July 19	20	20:19:36	20:14:36 – 20:34:36

Operations Readiness

Trajectory

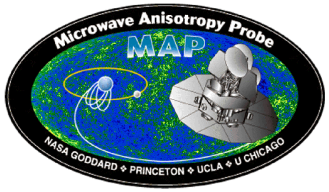
- Operations preparation is on schedule
  - **Conducting weekly internal Simulations since the beginning of Jan.**
  - **Procedures and Ops handbook are being updated and fine tuned after each simulation.**
  - **Training Matrix developed to track progress of the team.**
  - **Action Item List is being updated weekly in order to track internal trajectory action items.**
  - **Facility Requirements for the trajectory team identified and documented.**
  - **Interface Control Document between all teams has been signed off.**
  - **All Trajectory S/W has been fully tested and it is frozen for mission support.**
  - **Configuration Management is in place.**

- All required pre-launch analyses have been completed and delivered



Operations Readiness: Trajectory Software Status

- All Trajectory support software has been tested by an independent group and has been validated by the trajectory team.
- The S/W has been frozen since March 31, 2001 (L - 3 months)



Operations Readiness: Workstation Configuration

- Two trajectory Pentium III workstations have been installed in SMOC/MAR:
- Primary and backup Workstations have been configured for ops support (directories structured, STK standalone licenses installed, etc.)
- Configuration control procedures have been defined.

Operations Readiness: Procedures/Operations Handbook

Trajectory

- Procedures are being compiled into the “MAP Trajectory Team Procedures Handbook”

- CM copy of Ops Handbook is available on the maneuver team web site.
  - url:http://mapweb.gsfc.nasa.gov/users/sandrews/maneuver/maneuver.html

- All launch critical procs will be in place by L-30 days.

MAP trajectory team Sim schedule

Trajectory

Revised: 24 April, 2001

MAP Trajectory Team Simulation Schedule

			External Participation			
Simulation Name	**Exercise Date**	**Exercise Time**	**NAV**	**ACS**	**FDF**	**Notes**
P1	11 Jan 2001	9 AM – 12 noon				Completed – objectives met
P1 (repeat)	8 Feb 2001	9 AM – 12 noon	✓	✓		Completed – most objectives met, HiFi results excellent, FlatSat not executed
P1 (repeat)	22 Feb 2001	9 AM – 12 noon				Completed
Pf	8 Mar 2001	9 AM – 12 noon		✓		Completed – objectives met, HiFi results excellent
Launch	22 Mar 2001	9 AM – 5 PM	✓		✓	Completed
-2σ Launch	5 Apr 2001	9 AM – 5 PM	✓		✓	Cancelled due to conflicts with Project Sims
A1	26 Apr 2001	9 AM – 12 noon				Completed
Delayed P1	3 May 2001	9 AM – 5 PM	✓	✓		Cancelled due to conflicts with Project Sims
SK1	10 May 2001	9 AM – 12 noon	✓	✓		
Failover P1	17 May 2001	9 AM – 12 noon				Failover from Primary to Secondary WS
Pf CM	24 May 2001	9 AM – 12 noon	✓	✓	✓	
Partial Pf	31 May 2001	9 AM – 5 PM	✓	✓	✓	From OD, reconstruct, and planning MCCM
Launch (repeat)	7 Jun 2001	9 AM – 5 PM	✓		✓	
MCC	14 Jun 2001	9 AM – 12 noon				
Launch (repeat)	21 Jun 2001	9 AM – 5 PM	✓		✓	May be combined with final Project Launch sim

Notes:

- All sims are conducted on Thursdays, unless otherwise noted
- All sim data is based on nominal June 30 launch, unless otherwise noted.
- Sims in **red** indicate contingency sims
- This schedule does not include the Project sims

Operations Readiness: Training Assessment

- Each team member will be provided training on each procedure and will be required to demonstrate the needed level of proficiency
- Simulations and Special training exercises are used to educate and test the trajectory team.
- Training matrix developed to track progress of the team.
- The current overall level of proficiency is ~85% ready.
- It will 100% by L-30 days
  - **Further simulations and exercises (see schedule) will be conducted between now and L-30 days to complete the training.**

Trajectory Team Staffing

Trajectory

MISSION DAY =>	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
DAY OF WEEK=>	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue
CALENDAR DAY =>	29-Jun	30-Jun	1-Jul	2-Jul	3-Jul	4-Jul	5-Jul	6-Jul	7-Jul	8-Jul	9-Jul	10-Jul	11-Jul	12-Jul	13-Jul	14-Jul	15-Jul	16-Jul	17-Jul	18-Jul	19-Jul	20-Jul	21-Jul	22-Jul	23-Jul	24-Jul
SHIFT =>	Prime / Backup																									
Trajectory Team																										
Mike Mesarch	X	X	X			X		X				X	X	X	X			X		X				X	X	
Lauri Newman				X	X		X			X							X		X		X				
Mark Woodard		X			X			X	X		X					X									X
Conrad Schiff	X	X	X	X					X	X						X	X	X				X	X	X		
Dave Rohrbaugh					X	X	X	X			X	X	X	X					X	X	X	X			X	X
Jose Guzman		X							X	X	X				X	X	X						X	X	X	
Ariel Edery				X		X	X					X	X	X	X			X		X	X	X				X
Skip Owens	X	X	X	X				X	X	X						X	X	X					X	X	X	
Mission Manager																										
Osvaldo Cuevas		X	X	X	X	X			X		X		X	X				X				X	X			
Daryl Carrington		X		X		X			X																	
Key Events =>	Software Benchmark Tests	Launch @ 3:56 PM local			Thruster Cal CAM; A1 DV CAM	Primary Thruster Cal Burns	Apogee 1 @ 8:04 AM local; A1 DV	Secondary Thruster Cal Burns	P1 DV CAM	Perigee 1 @ 10:07 PM local; P1 DV	Contingency Thruster Cal Burns		A2 DV CAM	Apogee 2 @ 9:18 AM local; A2 DV				P2 DV CAM	Perigee 2 @ 8:38 PM local; P2 DV			A3 DV CAM	Apogee 3 @ 8:24 AM local; A3 DV			

Trajectory Team Staffing

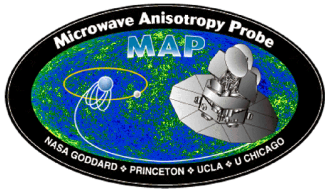
Trajectory

MISSION DAY =>	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
DAY OF WEEK=>	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun
CALENDAR DAY =>	25-Jul	26-Jul	27-Jul	28-Jul	29-Jul	30-Jul	31-Jul	1-Aug	2-Aug	3-Aug	4-Aug	5-Aug	6-Aug	7-Aug	8-Aug	9-Aug	10-Aug	11-Aug	12-Aug	13-Aug	14-Aug	15-Aug	16-Aug	17-Aug	18-Aug	19-Aug
SHIFT =>	Prime / Backup																									
Trajectory Team																										
Mike Mesarch	X						X					X	X	X	X											
Lauri Newman		X																								
Mark Woodard		X		X																						
Conrad Schiff							X																			
Dave Rohrbaugh		X		X								X	X	X	X											
Jose Guzman																										
Ariel Edery	X	X																								
Skip Owens							X																			
Mission Manager																										
Osvaldo Cuevas	X	X					X						X	X	X											
Daryl Carrington		X																								
Key Events =>	Pf DV CAM	Perigee 3 @ 8:28 PM local; Pf CM CAM	Pf CM DV @ ~ 2:28 PM			Lunar Swingby @ 7:38 PM	Lunar Swingby Debriefing						MCC CAM	MCC	MCC Debriefing											

Routine Operations Transition Plan

Trajectory

- Trajectory team (government and a.i. solutions personnel) will support all operations through the first SK maneuver
- After that, Government Personnel will phase out and a.i. solutions will take over all SK maneuver support for the lifetime of the mission
  - **Transition will be transparent since the same people continue to support.**
- Contract will be managed by the Project with Code 572 government personnel on call for anomaly resolution
- Procedures are in place for the trajectory team to use during mission operations.
  - **The ops handbook is a living document that will be continually modified**
  - **All necessary procedures will be documented by L - 30 day**



Trajectory Readiness Statement

– Trajectory Team Is Ready For Launch

Orbit Determination

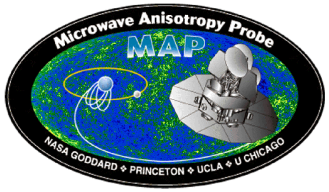
Dale Fink

MAP Orbit Determination Readiness

- **MAP Orbit Determination Support SW**
- **MAP Orbit Determination Personnel**
- **MAP Orbit Determination Data Sources**
- **MAP Orbit Determination Summary**

MAP Orbit Determination Support SW

- MAP is using GTDS NT in the MAP SMOC as prime location for OD, using 60-byte data ftp'ed from FDF. GTDS UNIX in FDF will be backup.
- GTDS NT was extensively tested, then verified by MAP OD Personnel using SOHO as a surrogate satellite. Finally, simulated tracking data for MAP was used for launch and maneuver support simulations.
- MAP OD Support SW is ready.

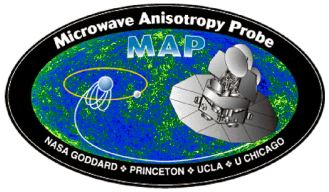


MAP Orbit Determination Personnel

- MAP OD Personnel are FDF veterans with many successful missions behind them.
- MAP OD Personnel have participated in all mission simulations.
- MAP OD Personnel are ready.

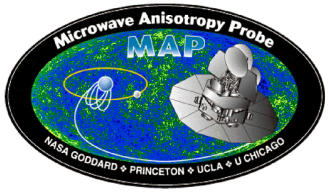
MAP Orbit Determination Data Sources

- MAP OD will use GTDS with TDRS and DSN data, a proven, reliable combination.
- MAP OD data sources are ready.



MAP Orbit Determination Summary

- MAP OD Support SW is ready.
- MAP OD Personnel are ready.
- MAP OD Data sources are ready.
- MAP OD is ready.



Attitude Determination
Sensor Calibration

Rick Harman

Attitude Determination and Sensor Calibration

- Requirements
- Architecture
- Schedule
- Status

Attitude Determination and Sensor Calibration

- Requirements:
  - Perform Ground Based Attitude Estimation
  - Perform Onboard Attitude Estimation Validation
  - Perform Sensor Calibration

Attitude Determination and Sensor Calibration

- Gyro Calibration Delivery:
  - Scale Factor Corrections (uplinked to MAP)
  - Alignment Corrections (uplinked to MAP)
  - Bias (NOT uplinked since spacecraft estimates this parameter)
- Maneuver Rationale:
  - Need a minimum of 4 independent maneuvers to solve for all 12 parameters
  - Thermal Constraints require sun to be within 22.5 degrees of spacecraft +Z-Axis

Attitude Determination and Sensor Calibration

- Gyro Calibration
  - Parameters for Science Observation Mode
  - Start with Sun Pointing Attitude
  - ± 90 Degree Maneuvers About Z-Axis
  - + 22 Degree Maneuver About X-Axis
  - ± 44 Degree Maneuvers About X-Axis
  - - 22Degree Maneuver About X-Axis
  - + 22 Degree Maneuver About Y-Axis
  - ± 44 Degree Maneuver About Y-Axis
  - - 22 Degree Maneuver About Y-Axis (return to Sun Pointing)
  - Maneuver Rate is 0.1 degrees/second

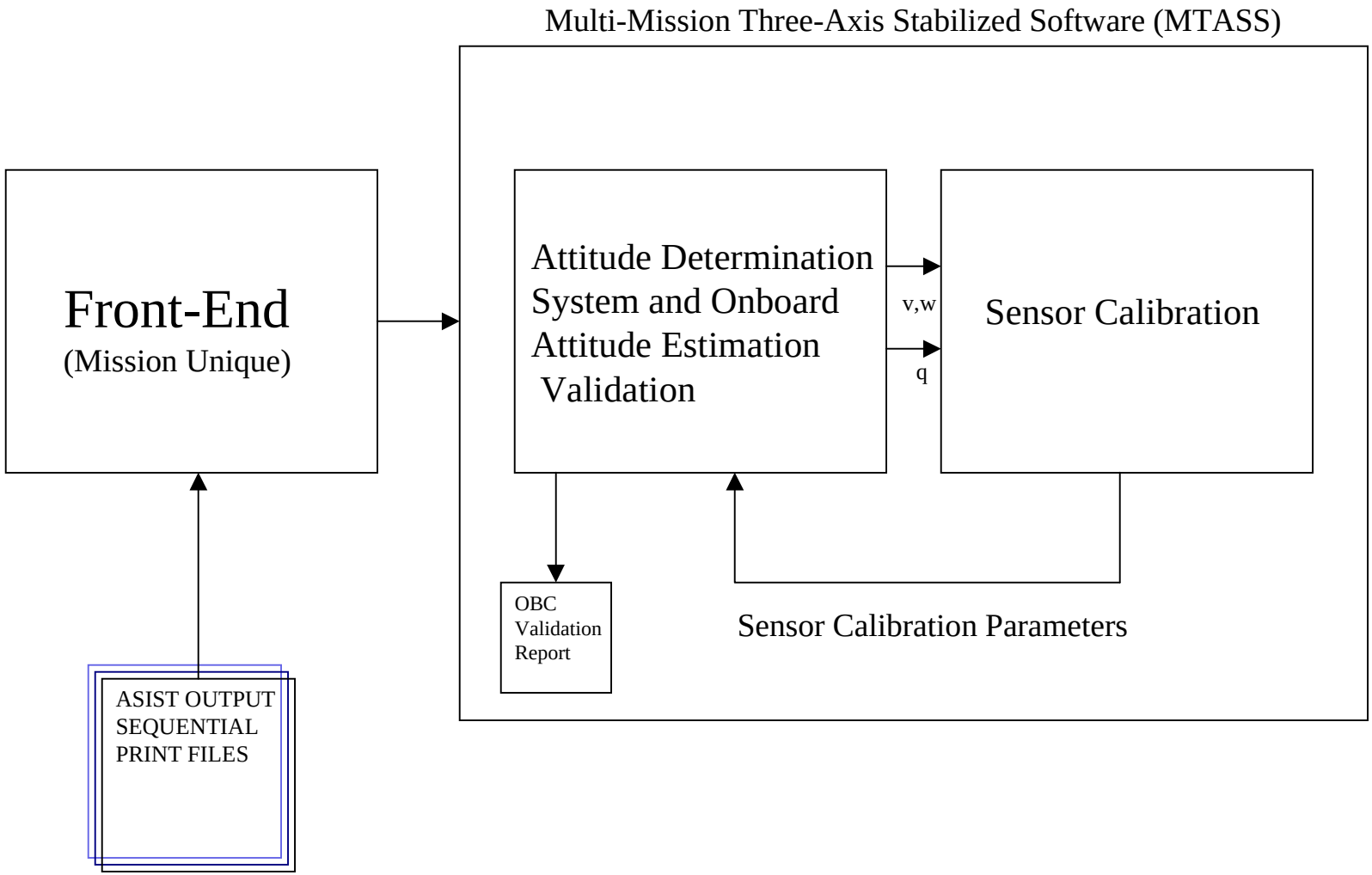
Attitude Determination and Sensor Calibration

- Star Tracker/Sun Sensor Deliveries (uplinked to MAP):
  - **Star Tracker#1,2 Alignment Matrices**
  - **Digital Sun Sensor#1,2 Alignment Matrices**
  - **Digital Sun Sensor#1,2 Field of View Calibration Coefficients (12-alpha angle,12-beta angle for each Digital Sun Sensor)**
- Maneuver Rationale:
  - **Observe Sun throughout both sun sensor fields of view to enhance field of view calibration as well as alignment calibration**
  - **Allow for a multitude of stars to move throughout the fields of view as well as groups to transverse multiple portions of the field of view**
  - **Slower speed allows for more observations in the field of view and decreases gyro induced propagation errors**

Attitude Determination and Sensor Calibration

- Star Tracker/Sun Sensor Calibration
  - Use Modified Observing Mode
  - 0.25 degree/sec rate about Z-Axis (2.5 degrees/second nominal)

Attitude Determination and Sensor Calibration



Attitude Determination and Sensor Calibration

- Schedule
  - Day 2 (Coarse Gyro Calibration)
  - Day 3 (Deliver Preliminary Gyro Calibration Results-Prior to Perigee Maneuver)
  - Day 3 (Star Tracker-Sun Sensor Calibration)
  - Day 22 (Deliver Final Gyro and Star Tracker Calibration Parameters)
  - Day 23 (Calibration Verification Using Fine Gyro Calibration Maneuvers)

Attitude Determination and Sensor Calibration

- Staffing: 4
- System Location: NAVGSE
- System Status: Ready for Launch

Attitude Determination and Sensor Calibration

- Status: Ready for Launch

Flight Software Status

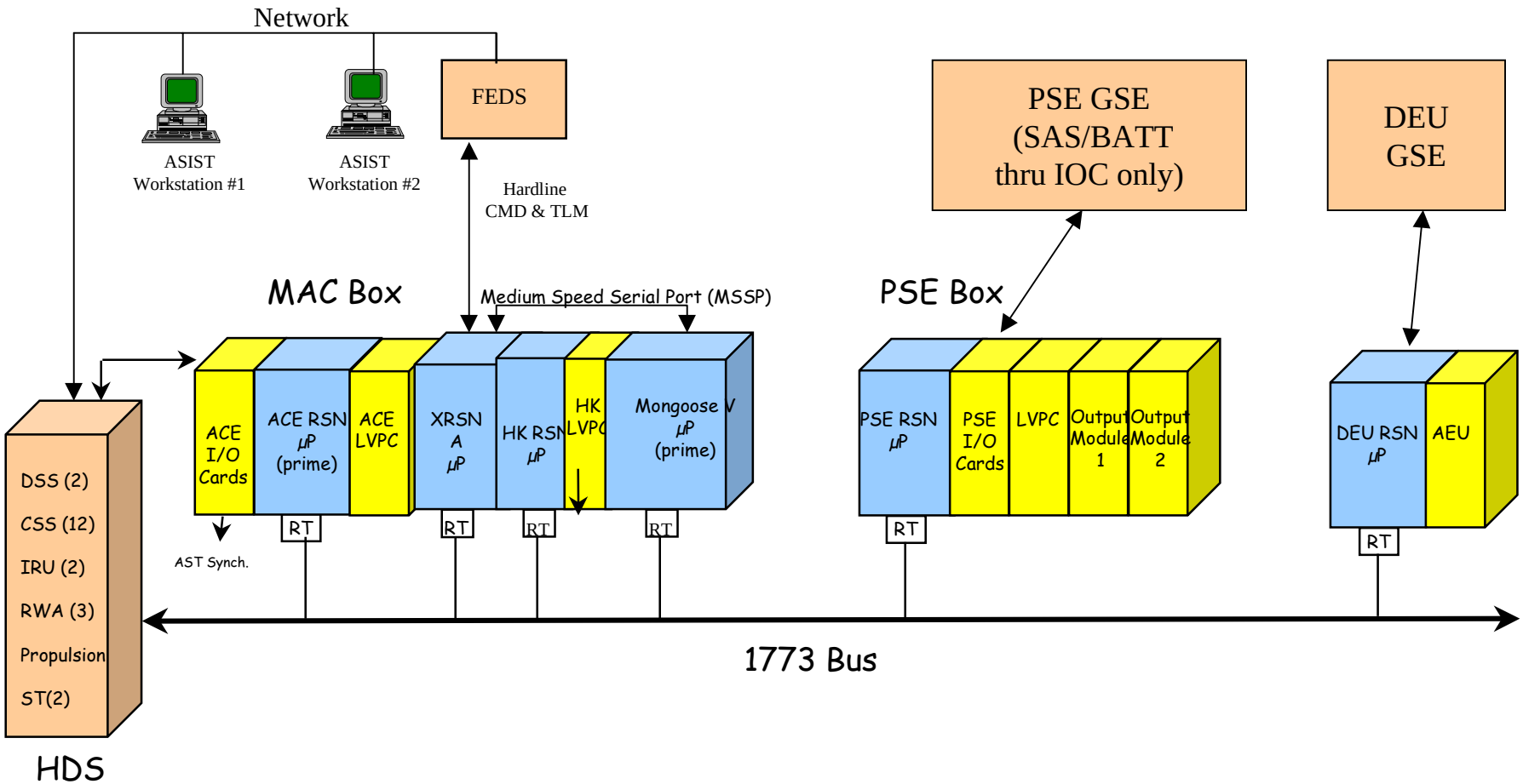
Jane Marquart

FSW Maintenance

- GSFC/s Flight Software Branch (Code 582) to provide on-orbit maintenance (through CSC contractor)
- Flight Software Maintenance will take place in the MAP ETU facility (Building 1)

Maintenance Facility

FSW Development Machine
Has serial connections to
M-V and all RSNs



Maintenance Activities

- Pre-Launch Activities:
  - Move and re-certify testbed 5/21/01
  - Develop FSW Maintenance Plan 4/7/01 (draft)
  - Develop Flatsat functional test suite 6/15/01
  - Verify tools; coordinate with FOT - ongoing
  - Develop FSW library - ongoing
  - Dump all tables prior to launch 5/01

Maintenance Activities

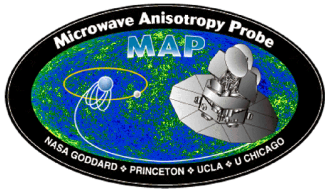
- Post-launch
  - Maintenance team supporting mission sims with anomalies
  - Maintenance team developed TSM/RTS patches for subsystem testing
  - Maintenance team part of 2-wheel contingency plan
  - Maintenance team has taken over CM system
  - Agreement reached for CCB procedure

Launch Status

FSW IS ON TRACK FOR LAUNCH

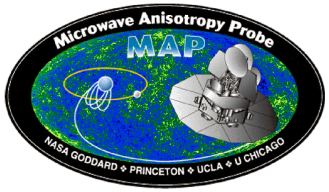
Conclusion

Steven Coyle



Mission Operations Status

Element	Status
Flight Software Maintenance	**Ready**
Science Operation & Data Processing	**Ready**
Ground System	**Ready**
Launch and IOC Ops Preps	L&IOC timelines and scripts are complete, all ops procs are tested or signed pending test. Complete 5/23
Networks	DSN: **Ready**, ORT testing continues. TDRSS: **Ready**, Mila Relay testing continues
Trajectory and Navigation	**Ready**: Trajectory to ground ICD needs minor cleanup and signature
Planning, Trending and L0 Processing	**Ready**
Training and Sim Preps of Ops Personnel	Team is in place; Systems and SS have participated in all Sims, SCT certification complete. 14 of 19 Sims complete



Conclusion

- The MAP Operations Team and Ground Systems are **READY** for Launch